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THE NEW ARITHMETIC

COMPILED BY

THREE HUNDRED PROMINENT EDUCATORS

AND EDITED BY

SEYMOUR EATON,


Author of Eaton's Practical Grammar, and Editor of the School Supplement.

TORONTO:
EATON, GIBSON & CO.

1885.



Entered, according to Act of Parliament of Canada, in the year one thousand eight hundred and eighty-five, by EATON, GIBSON & Co., in the Office of the Minister of Agriculture at Ottawa.



T192

PRINTED AT THE CHRISTIAN GUARDIAN OFFICE, TORONTO.

EDITOR'S NOTE.

THE contributors to the exercises in this book are about three hundred in number. The names of those from whose contributions I have drawn most largely are adjoined. I am myself responsible for the plan of the work, for the grading, and for a large number of the exercises. Explanations of theory, and other introductory matter, which the teacher should himself provide, I have purposely omitted. I have endeavored to prepare a *pupils'* hand-book. The practical character of the exercises will commend them to all who have at heart the mental development and the business success of their pupils. I have avoided all exercises requiring much labor and affording very little intellectual or practical benefit. The work of the elementary departments prepares the pupil for the study of algebra, geometry, and the higher mathematics, while the more advanced work prepares him for the active duties of everyday life, and at the same time gives him such mathematical training as he may not have time to secure in any other way.

Suggestions and criticisms are solicited.

SEYMOUR EATON.

TORONTO, *May*, 1885.

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THE NEW ARITHMETIC.

FIRST DEPARTMENT.

I. ADDITION.

HINTS AND DEFINITIONS.

The **sum** or **amount** of two or more numbers is the number equivalent to all the units of the given numbers.

The **sign of addition** is $+$. It is read *plus*.

The **sign of dollars** is $\$$. It is read *dollars*.

The **sign of equality** is $=$. It is read *equals*, or *is equal to*.

Write the numbers in vertical lines. Irregularity in the placing of figures is the cause of many errors.

Think of results, and not of the numbers themselves. Thus, do not say 4 and 5 are 9, and 6 are 15, and 7 are 22, etc.; but 9, 15, 22, etc.

Make combinations of 10 or other numbers as often as possible, and add them as single numbers. Thus, in adding $\begin{array}{r} 9\ 34\ 73\ 214\ 9\ 54\ 82\ 123 \\ \hline \end{array}$, say 9, 16, 26, 33, 42, 51, 61, 67, taking each group at a glance as a single number. When a figure is repeated several times, multiply instead of adding.

In adding horizontally, begin at the left, since the eye is more accustomed to moving from left to right than from right to left.

In adding long columns, prove the work by adding each column separately in the opposite direction before adding the next column.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

1. Find the sum of 24, 26, 37, 85, 63, 42, 21, and 13.
2. Find the sum of 37, 201, 402, 42, 25, 101, and 202.
3. Find the sum of the numbers between 9 and 20.

4. Find the sum of all the numbers ending with 5 between 10 and 60.

5. Find the sum of the four numbers that can be expressed by the figures 3 and 5.

6. Find the sum of the four numbers that can be expressed by the figures 6 and 9.

7. Find the sum of all the numbers from 12 to 48 inclusive.

NOTE.—When numbers are in regular *arithmetical* order, as 3, 4, 5, 6, or 2, 4, 6, 8, or 5, 10, 15, etc., to find their sum, add the first and last, take half, and multiply by the number of numbers. The half-sum represents the middle or average number.

8. Find the sum of all the even numbers between 1 and 101.

9. Find the sum of all the numbers from 3 to 37 inclusive.

10. Find the sum of all the odd numbers between 50 and 100.

11. Find the sum of all the numbers ending with 5 between 1 and 100.

12. Find the sum of all the numbers from 1 to 999 inclusive.

13. How many days in the summer months?

14. How many letters will it take to write 425 in words?

15. How many letters will it take to write 23,249 in words?

WRITTEN DRILL EXERCISES.

16. How many letters will it take to write 2,304,625 in words?

17. Find the sum of the fifteen numbers that can be expressed by the figures 1, 2, and 3.

18. Find the sum of the fifteen numbers that can be expressed by the figures 3, 5, and 7.

19. Find the sum of the ten numbers that can be expressed by the figures 2, 5, and 0.

20. Find the sum of the five numbers that can be expressed by the figures 2, 2, and 0.

21. Find the sum of the eight numbers that can be expressed by the figures 2, 5, and 5.

22. Find the sum of the three numbers that can be expressed by the figures 7, 7, and 7.

23. Find the sum of all the numbers between 999 and 1201.

24. Find the sum of all the numbers between 1904 and 3154.

25. A man who was born in 1826 died when he was 49 years old. In what year did he die?

26. How long a cord will it take to go round a garden 327 feet long and 298 feet wide?

27. Add together the six numbers of three figures each that can be formed with 5, 6, and 7.

28. Find the sum of all the numbers ending with 789 between 71836 and 82325.

29. Find the sum of all the numbers ending with 55 between 10020 and 12001.

30. How many years from the beginning of 3984 B.C. until the beginning of 1886 A.D.?

31. How many days from 12 o'clock p.m. March 31 until 12 o'clock p.m. January 31?

32. Find the sum of the five largest numbers that can be expressed by the figures 9, 8, 7, and 6.

33. Find the sum of the five smallest numbers, of four figures each, that can be expressed by using the figures 3, 4, 0, and 5.

34. Find the sum of the five largest and the five smallest numbers, of four figures each, that can be expressed by the figures 9, 8, 3, and 1.

35. How many times will a clock strike between 11.15 a.m. and 10.30 p.m.?

36. The difference between two numbers plus 12 is equal to 28. Their sum is 64. Find the numbers.

39. ATTENDANCE AT AN INDUSTRIAL EXPOSITION.

40. AGGREGATE ATTENDANCE AT A PUBLIC SCHOOL.

[illegible]

41. WEEKLY REPORT OF A CIRCULATING LIBRARY.

[illegible]

42. DENOMINATIONAL POPULATION OF A CITY.

	Ward A.	Ward B.	Ward C.	Ward D.	Ward E.	Ward F.	Total
Baptist.....	2364	1425	2643	1021	1234	985	*****
Methodist.....	3472	2163	2542	998	3298	1063	*****
Presbyterian.....	2123	1565	2121	896	2163	2054	*****
Episcopal.....	1984	1023	984	1542	3429	204	*****
Congregational...	842	1254	856	355	1063	1365	*****
Roman Catholic..	567	1986	921	1568	2125	998	*****
Other Denom.....	1321	255	429	843	899	1254	*****
Total.....	*****	*****	*****	****	*****	*****	*****

43. A LUMBER MERCHANT'S SALES FOR ONE WEEK.

[illegible]

44. COLUMNS OF MONEY ITEMS.

[illegible]

45. COLUMNS OF MONEY ITEMS.

[illegible]

II. SUBTRACTION.

HINTS AND DEFINITIONS.

The **difference** between two numbers is a number which, added to the less, gives a sum equal to the greater.

When a part is taken from the whole, the difference is called the **remainder**.

Subtraction is the process of finding the difference between two like numbers.

The greater number is called the **minuend**, and the smaller number the **subtrahend**.

The **sign of subtraction** is — . It is read *minus*.

The sum of the remainder and the subtrahend is equal to the minuend.

The difference between the remainder and the minuend is equal to the subtrahend.

BUSINESS EXERCISES.

NOTE.—Salesmen usually make “change” by addition. They, however, have the money to count out, and in doing so they add to the amount of the purchase until they reach the amount of the bill presented. In the following exercises find the “change” by subtracting the amount of the account from the value of the bill or bills presented. Do not use pen or pencil, except to write the answers.

- | | | |
|-----------------------|----------------------|------------------------|
| 46. \$10 00 — \$3 14. | 51. \$5 00 — \$1 90. | 56. \$40 00 — \$23 18. |
| 47. \$15 00 — \$2 13. | 52. \$1 00 — \$0 45. | 57. \$25 00 — \$15 65. |
| 48. \$30 00 — \$9 94. | 53. \$2 00 — \$1 20. | 58. \$20 00 — \$13 21. |
| 49. \$10 00 — \$7 16. | 54. \$2 00 — \$1 03. | 59. \$15 00 — \$11 15. |
| 50. \$20 00 — \$2 95. | 55. \$7 00 — \$2 65. | 60. \$50 00 — \$22 68. |

NOTE.—In the following examples the amount of a certain bank deposit is followed by the amounts of the checks issued during a definite period of time. The pupil will put down the amount of the deposit and then subtract the amounts of the checks in order, one at a time, putting down each balance. Nothing but the deposit and the several balances should go on the slate or paper.

61. Deposit, \$247.85. Checks, \$4.85 ; \$5.96 ; \$10.00 ; \$8.13.
62. Deposit, \$397.63. Checks, \$142.15 ; \$16.85 ; \$2.36 ; \$18.95.

63. Deposit, \$429.21. Checks, \$215.12 ; \$32.98 ; \$47.63 ; \$3.85 ; \$2.25.

64. Deposit, \$986.43. Checks, \$314.18 ; \$49.25 ; \$57.62 ; \$39.84 ; \$25.13.

65. Deposit, \$276.20. Checks, \$32.85 ; \$24.19 ; \$37.64 ; \$25.93 ; \$3.27.

66. Deposit, \$1000. Checks, \$120.25 ; \$14.98 ; \$13.25 ; \$2.17 ; \$25.00 ; \$18.62 ; \$27.38.

67. Deposit, \$1254.85. Checks, \$13.65 ; \$92.80 ; \$87.63 ; \$25.17 ; \$254.85 ; \$24.18 ; \$37.20.

68. Deposit, \$2765.90. Checks, \$1249.84 ; \$2.16 ; \$3.95 ; \$276.48 ; \$306.27 ; \$14.27 ; \$294.18.

69. Deposit, \$2940.25. Checks, \$140.00 ; \$27.35 ; \$69.80 ; \$1000.00 ; \$297.60 ; \$4.25 ; \$324.18.

70. Deposit, \$32956.25. Checks, \$3425.84 ; \$2625.18 ; \$2.45 ; \$999.80 ; \$243.50 ; \$15.87 ; \$1200.00.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

71. From 245 take 194.

72. From 376 take 215 ; then 84 from the remainder.

73. How old is a building in 1885 which was erected in 1734 ?

74. How old is a man in 1886 who was born in 1784 ?

75. I give a ten-dollar bill in paying an account of \$3.42. How much change should I get ?

76. What number taken from 324 will leave 189 ?

77. The sum of two numbers is 524 ; the greater is 339 ; what is the less ?

78. From the largest number that can be expressed by the figures 2, 4, and 9, subtract 321.

79. A school has 427 pupils, 139 of whom are girls. How many boys are there ?

80. How many days from Christmas until January 15th inclusive ?

WRITTEN DRILL EXERCISES.

81. I bought a cow for \$35 and a horse for \$165, and paid \$120 down. How much have I yet to pay ?

82. Find the sum of the ages in 1886 of three men who were born in 1823, 1835, and 1847 respectively.

83. I give a fifty-dollar bill in paying an account of \$23.35. How much change should I get ?

84. From 1005090010210 take 90091019012.

85. From 900999010908 take 78400215040.

86. The sum of two numbers is 309801 ; the greater is 199082 ; what is the less ?

87. From the largest number that can be expressed by the figures 6, 4, 5, 3, and 2, subtract the smallest number that can be expressed by the same figures.

88. Find the difference between the largest and the smallest numbers that can be expressed by all the nine digits.

89. A table with two leaves is 50 inches wide when the leaves are up, and 22 inches wide when the leaves are down. How wide is each leaf ?

90. How many days from March 16 until October 4 ?

NOTE.—Subtract 16 from the number of days in March and we have 15. Add to this the number of days in April, May, June, July, August, and September, and the 4 days of October, and we have 202, the correct number.

91. How many days from June 30 until December 26 ?

92. How many days from July 15 until February 22 ?

93. How many days from March 22 until November 18 ?

94. How many days from August 31, 1885, until June 1, 1886?
95. The sum of three numbers is 101050; the first is 9999; the second is 1010 more than the first; what is the third number?
96. The sum of two numbers is 847; one is the difference between 728 and 1110; find the other.
97. A man had \$425 in a bank; he drew out \$149; deposited \$363, and then drew out \$54. How much remained to his credit in the bank?
98. The difference between two numbers is 2001005; the larger is 99009099; find the smaller.
99. Find the sum of the ages in 1887 of four men who were born in 1813, 1792, 1826, and 1836 respectively.
100. Mr. Walker and Mr. Thompson live, respectively, 987 miles and 239 miles west of the same city. How far apart do they live?
-

III. MULTIPLICATION.

HINTS AND DEFINITIONS.

The **product** of two or more numbers is the result obtained by repeating one number as many times as there are units in the other.

Multiplication is the process of finding the product of two numbers.

The **multiplicand** is the number to be multiplied.

The **multiplier** is the number which shows how many times the multiplicand is to be taken.

The **sign of multiplication** is \times . It is read *times*, or *multiplied by*.

The product divided by the multiplicand gives the multiplier.

The product divided by the multiplier gives the multiplicand.

The multiplicand and multiplier are often called **factors** of the product.

The term **continued product** is sometimes applied to the product of several numbers.

The **numerical result** of multiplying one number by another is the same whichever is taken as the multiplicand, the other being taken as the multiplier. The product will always denote the same kind of units as the true multiplicand.

SHORT METHODS.

NOTES.—To multiply any number by 11, write the first right-hand figure, add the first and second, the second and third, and so on; finally write the left-hand figure. Carry when necessary.

To multiply 358425 by 11, write the right-hand figure 5; then say 5 and 2 are 7; 2 and 4, 6; 4 and 8, 12, put down 2 and carry 1; 8 and 5 and 1 are 14, put down 4 and carry 1; 5 and 3 and 1 are 9; then write the left-hand figure 3, and you have 3942675.

$$101. 235 \times 11. \qquad 108. 2135 \times 11. \qquad 115. 23125 \times 11.$$

$$102. 346 \times 11. \qquad 109. 4214 \times 11. \qquad 116. 23412 \times 11.$$

$$103. 842 \times 11. \qquad 110. 3132 \times 11. \qquad 117. 13562 \times 11.$$

$$104. 215 \times 11. \qquad 111. 2152 \times 11. \qquad 118. 24234 \times 11.$$

$$105. 327 \times 11. \qquad 112. 3728 \times 11. \qquad 119. 31421 \times 11.$$

$$106. 227 \times 11. \qquad 113. 2634 \times 11. \qquad 120. 52123 \times 11.$$

$$107. 324 \times 11. \qquad 114. 4215 \times 11. \qquad 121. 21632 \times 11.$$

NOTE.—Multiply 76 by 74. Note that the two left-hand figures are the same, and the two right-hand figures add to ten. Multiply the two right-hand figures, 6 and 4, and place the product, 24, in the answer; then multiply one of the left-hand figures by the number next larger, 7 by 8 (7+1), and the product, 56, placed to the left of the two figures already obtained, makes the correct result, 5624. Do not use pen or pencil, except to write the answer.

$$24 \times 26, 4 \times 6 = 24, \text{ and } 2 \times 3 = 6, 624.$$

$$37 \times 33, 7 \times 3 = 21, \text{ and } 3 \times 4 = 12, 1221.$$

$$91 \times 99, 9 \times 1 = 09, \text{ and } 9 \times 10 = 90, 9009.$$

$$122. 24 \times 26. \quad 128. 27 \times 23. \quad 134. 128 \times 122. \quad 140. 107 \times 103.$$

$$123. 17 \times 13. \quad 129. 18 \times 12. \quad 135. 112 \times 118. \quad 141. 108 \times 102.$$

$$124. 34 \times 36. \quad 130. 33 \times 37. \quad 136. 104 \times 106. \quad 142. 111 \times 119.$$

$$125. 25 \times 25. \quad 131. 42 \times 48. \quad 137. 143 \times 147. \quad 143. 132 \times 138.$$

$$126. 35 \times 35. \quad 132. 57 \times 53. \quad 138. 152 \times 158. \quad 144. 295 \times 295.$$

$$127. 85 \times 85. \quad 133. 61 \times 69. \quad 139. 127 \times 123. \quad 145. 392 \times 398.$$

146. 94×96 . 150. 65×65 . 154. 113×117 . 158. 497×493 .
 147. 37×33 . 151. 84×86 . 155. 115×115 . 159. 597×593 .
 148. 43×47 . 152. 93×97 . 156. 125×125 . 160. 791×799 .
 149. 46×44 . 153. 56×54 . 157. 195×195 . 161. 992×998 .

NOTE.—Multiply 124 by 104. Multiply the excesses—that is, 24 by 4—and put down the product, 96, two places to the right-hand side, as in the illustration below. Then add the two numbers, 104 and 124, omitting one of the *ones* at the left. Carry when necessary.

124	$24 \times 4 = 96$	112
104	$4 + 4 = 8$	106
<hr style="width: 50px; margin: 0;"/>	$2 + 0 = 2$	<hr style="width: 50px; margin: 0;"/>
12896		11872

NOTE.—Multiply 1234 by 1002. Multiply 234 by 2, and put down the product, 468, three places to the right-hand side. Then add 234 and 1002. The product will be 1236468.

- | | | |
|-------------------------|-------------------------|---------------------------|
| 162. 112×106 . | 176. 113×106 . | 190. 1007×1102 . |
| 163. 113×105 . | 177. 119×107 . | 191. 1312×1003 . |
| 164. 114×102 . | 178. 135×104 . | 192. 1009×1004 . |
| 165. 115×107 . | 179. 142×102 . | 193. 1003×1006 . |
| 166. 113×103 . | 180. 158×103 . | 194. 1007×1008 . |
| 167. 102×104 . | 181. 137×103 . | 195. 1012×1003 . |
| 168. 122×108 . | 182. 102×114 . | 196. 1012×1004 . |
| 169. 106×111 . | 183. 104×105 . | 197. 1098×1002 . |
| 170. 112×103 . | 184. 105×102 . | 198. 1006×1009 . |
| 171. 122×105 . | 185. 105×106 . | 199. 1002×1212 . |
| 172. 121×102 . | 186. 106×104 . | 200. 1342×1002 . |
| 173. 127×103 . | 187. 107×109 . | 201. 1099×1009 . |
| 174. 124×104 . | 188. 106×108 . | 202. 1199×1005 . |
| 175. 128×105 . | 189. 109×108 . | 203. 1265×1003 . |

NOTE.—Multiply 95 by 97. The *complement* of a number is the difference between the number and the unit of the next higher order. Thus, the complement of 95 is 5; of 97 is 3; of 987 is 13, etc.

$$\begin{array}{r} 95 \dots\dots 5 \text{ (complement)} \\ 97 \dots\dots 3 \text{ (complement)} \\ \hline 9215 \end{array}$$

Multiply the complements. Five times three are fifteen. Place 15 in the product. For the remaining two figures subtract either the 5 from the 97 or the 3 from the 95. There should be the same number of figures in the product as in the multiplier and multiplicand together.

204. 97×98 .	214. 95×94 .	224. 93×92 .	234. 994×995 .
205. 99×88 .	215. 94×96 .	225. 99×93 .	235. 993×994 .
206. 99×97 .	216. 99×94 .	226. 92×94 .	236. 999×992 .
207. 97×96 .	217. 94×98 .	227. 95×92 .	237. 995×993 .
208. 96×98 .	218. 95×93 .	228. 96×92 .	238. 989×998 .
209. 99×96 .	219. 96×93 .	229. 98×91 .	239. 991×997 .
210. 96×95 .	220. 93×97 .	230. 89×98 .	240. 992×995 .
211. 97×95 .	221. 98×93 .	231. 87×99 .	241. 987×998 .
212. 95×98 .	222. 97×94 .	232. 93×89 .	242. 988×997 .
213. 99×95 .	223. 94×93 .	233. 92×92 .	243. 975×998 .

NOTE.—Multiply 37 by 43. The mean number—that is, the number which is as much greater than 37 as it is less than 43—is 40. Forty squared, or multiplied by itself, gives 1600. The square of 3, the difference between the mean number and one of the numbers, is 9. $1600 - 9 = 1591$ = the product of 37 and 43.

244. 87×73 .	249. 48×52 .	254. 112×108 .	259. 1012×988 .
245. 63×57 .	250. 24×16 .	255. 116×124 .	260. 1009×991 .
246. 22×18 .	251. 31×29 .	256. 115×105 .	261. 1025×975 .
247. 93×87 .	252. 45×35 .	257. 118×122 .	262. 1004×996 .
248. 42×38 .	253. 72×68 .	258. 131×129 .	263. 1011×989 .

NOTE.—Multiply 76 by 46. Multiply units by units for the first figure of the product, the sum of the tens by units for the second figure, and tens by tens for the third figure, carrying when necessary.

$$\begin{array}{r}
 76 \\
 46 \\
 \hline
 3496
 \end{array}
 \begin{array}{l}
 6 \times 6 = 36, \text{ carry } 3 \\
 6 \times (7 + 4) = 6 \times 11 = 66, \text{ and } 3 \text{ to carry, } 69 \\
 4 \times 7 = 28, \text{ and } 6 \text{ to carry, } 34
 \end{array}$$

264. 56×56 .	269. 99×49 .	274. 125×65 .	279. 114×114 .
265. 72×32 .	270. 85×75 .	275. 126×36 .	280. 142×162 .
266. 94×44 .	271. 34×24 .	276. 154×84 .	281. 123×183 .
267. 65×75 .	272. 85×45 .	277. 132×92 .	282. 137×177 .
268. 87×37 .	273. 47×37 .	278. 133×73 .	283. 264×244 .

NOTE.—Multiply 87 by 82. Multiply units by units for the first figure of the product, the sum of the units by tens for the second figure, and tens by tens for the remaining figures, carrying when necessary.

$$\begin{array}{r}
 87 \\
 82 \\
 \hline
 7134
 \end{array}
 \begin{array}{l}
 7 \times 2 = 14, \text{ carry } 1 \\
 8 \times (7 + 2) = 8 \times 9 = 72, \text{ and } 1 \text{ to carry, } 73 \\
 8 \times 8 = 64, \text{ and } 7 \text{ to carry, } 71
 \end{array}$$

284. 81×87 .	289. 83×87 .	294. 116×117 .	299. 93×94 .
285. 62×63 .	290. 47×44 .	295. 127×122 .	300. 76×73 .
286. 54×55 .	291. 56×52 .	296. 107×105 .	301. 51×53 .
287. 43×41 .	292. 79×75 .	297. 125×122 .	302. 91×94 .
288. 27×22 .	293. 44×43 .	298. 113×114 .	303. 82×83 .

NOTE.—Multiply 3214 by 31 or 13. Instead of writing 31 under the multiplicand, as is the custom, multiply by 3 and place the product one figure to the left, under the multiplicand, and add. To multiply by 13, place the product one figure to the right and add.

3214×31	3214×13
9642	9642
<hr/>	<hr/>
99634	41782

304. 2134×13 .	306. 3242×15 .	308. 2152×17 .
305. 1325×14 .	307. 4135×16 .	309. 3428×18 .

310. 4006×19 .	318. 3123×91 .	326. 3109×108 .
311. 8213×21 .	319. 4284×101 .	327. 1243×109 .
312. 6204×31 .	320. 3121×102 .	328. 3152×201 .
313. 3123×41 .	321. 4134×103 .	329. 4284×301 .
314. 1242×51 .	322. 2152×104 .	330. 3212×401 .
315. 2153×61 .	323. 1320×105 .	331. 4623×501 .
316. 3216×71 .	324. 3121×106 .	332. 2136×601 .
317. 2148×81 .	325. 4282×107 .	333. 1038×701 .

BUSINESS EXERCISES.

DIRECTION.—In the following exercises find the total value of the articles under each head.

334. FARM PRODUCE.

213 lbs. butter at 22c.
 102 lbs. cheese at 18c.
 114 doz. eggs at 15c.
 232 qts. milk at 6c.
 127 bu. potatoes at 65c.
 132 bu. carrots at 60c.

337. FARM PRODUCE.

113 bu. wheat at \$1.22.
 217 bu. barley at \$1.05.
 324 bu. oats at 45c.
 716 bu. rye at 95c.
 322 bu. peas at 75c.
 136 bu. corn at 89c.

335. FARM PRODUCE.

105 bu. turnips at 50c.
 113 bu. beets at 80c.
 114 bu. parsnips at 93c.
 215 bu. onions at 98c.
 236 bu. tomatoes at 42c.
 137 doz. cabbages at 48c.

338. GROCERIES.

25 lbs. rice at 4c.
 37 lbs. tapioca at 15c
 43 lbs. sago at 13c.
 37 lbs. barley at 5c.
 42 lbs. dried apples at 9c.
 33 lbs. prunes at 7c.

336. FARM PRODUCE.

215 bbls. apples at \$2.15.
 420 bu. plums at \$1.20.
 132 bu. peaches at \$1.75.
 215 bu. cherries at \$1.35.
 217 bu. pears at \$1.50.
 130 bu. quinces at \$1.40.

339. GROCERIES.

25 lbs. sugar at 7c.
 32 lbs. tea at 47c.
 84 lbs. coffee at 52c.
 62 lbs. raisins at 11c.
 39 lbs. currants at 9c.
 47 lbs. biscuits at 12c.

NOTE.—Flour is sold at present by the barrel, bag, and sack. The barrel is supposed to contain 196 pounds. The bag contains 100 pounds, and the sacks 50 pounds and 25 pounds. A stone is equal to 14 pounds.

340. FLOUR AND FEED.

- 25 bbls. flour at \$5.60.
- 32 bags flour at \$2.75.
- 19 bags bran at 90c.
- 14 stone oat meal at 48c.
- 18 stone corn meal at 36c.
- 27 lbs. wheat meal at 7c.

342. BUTCHERS' SUPPLIES.

- 27 lbs. pork at 18c.
- 32 lbs. beef at 12c.
- 18 lbs. mutton at 14c.
- 12 lbs. veal at 15c.
- 18 lbs. lamb at 17c.
- 25 lbs. ham at 13c.

341. DRY GOODS.

- 38 yds. cotton at 7c.
- 42 yds. cashmere at 58c.
- 37 yds. flannel at 35c.
- 52 yds. muslin at 19c.
- 64 yds. print at 14c.
- 52 yds. lace at 98c.

343. COAL AND WOOD.

- 12 tons hard coal at \$6.25.
- 14 tons soft coal at \$4.35.
- 18 cords maple at \$6.50.
- 25 cords oak at \$5 30.
- 12 cords pine at \$3.40.
- 24 tons coke at \$3.90.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

344. $2 \times 3 \times 5 \times 4 \times 6 \times 10 \times 2$.

345. $4 \times 2 \times 5 \times 7 \times 2 \times 3 \times 10$.

346. $(9 \times 2) + (7 \times 2) + (12 \times 2) + (24 \times 2) + (8 \times 2)$.

NOTE.— 9×2 plus 7×2 is equal to 9 plus 7 or 16 multiplied by 2. In exercise 346 add 9, 7, 12, 24 and 8, and multiply the product by 2.

347. $(12 \times 13) + (8 \times 13) + (87 \times 20)$.

348. $(24 \times 32) + (23 \times 32) + (47 \times 28) + (53 \times 60)$.

NOTE.— $24 + 23 = 47$. 47×32 and $47 \times 28 = 47 \times 60$. This and $53 \times 60 = (47 + 53)$ or $100 \times 60 = 6000$. Answer.

349. $(321 \times 224) + (247 \times 613) + (753 \times 389) + (432 \times 224)$.

350. $(42 \times 48) + (34 \times 36)$.

351. $(55 \times 55) + (43 \times 47)$.

352. Find the cost of 92 articles at 98 cents each.

353. Find the cost of 83 articles at 87 cents each.

354. How much will a boy earn in 92 hours at 15 cents an hour?

NOTE.—To multiply by 15, multiply by 10 and add half the product to itself. Thus, $920 + 460 = 1380 = 92 \times 15$.

355. 2312×11 .

356. 999×999 .

357. 104×105 .

WRITTEN DRILL EXERCISES.

358. Multiply 39005010 by 30900.

359. Find the product of 2005004 and 32605.

360. Find the product of all the numbers, of three figures each, that can be expressed by the figures 3, 5, and 0.

361. How much must be paid for hauling 2352 loads of sand at \$1.25 per load?

362. How much will 753 pounds of sugar cost at 9 cents a pound?

363. Find the cost of 122 building lots at \$364 a lot.

364. A clerk's salary is \$72 a month. If he spends \$27 a month, how much can he save in a year?

365. What is the cost of 122 bales of cotton at 13 cents a pound, if each bale contains 477 pounds?

366. Multiply 2 by 2, then 4 by 4, then that product by itself, and so on until the product contains ten figures.

367. Find the cost of building 904 miles of railway at \$26,342 a mile.

368. Multiply 2098465 by 77, using factors.

369. Multiply 9800431 by 63, using factors.

370. Multiply the sum of 1001 and 10010 by their difference.

371. What will it cost to build 11 houses at \$5329 each?

372. Find the value of 2631 bushels of wheat at \$1.13 a bushel?

373. Find the value of 342 tons of hay at \$17.25 a ton.

374. What is the difference in cost of 174 head of cattle at \$37.75 a head and 1260 head of sheep at \$5.50 a head?

375. A miller exchanged 164 barrels of flour at \$7.35 a barrel for 920 bushels of wheat at \$2 a bushel, paying the balance in money. How much money did he pay?

376. Multiply 205090 by 105, using three factors.

NOTE.—Sound travels 1090 feet in one second.

377. You see the puff of a steam-whistle 11 seconds before you hear the sound. How far are you from it?

378. If a man travels 75 yards in a minute, how far will he travel in 12 hours?

IV. DIVISION.

HINTS AND DEFINITIONS.

The **divisor** is the number by which to divide.

The **dividend** is the number to be divided.

The result obtained by dividing is called the **quotient**.

The **remainder** is that part of the dividend which remains after the division has been completed.

The **sign of division** is \div . It is read, *divided by*.

To **prove** the work, multiply the quotient and divisor, and add the remainder to the product.

Any change in the divisor, by multiplication or division, will produce an opposite change in the quotient.

Any change in the dividend, by multiplication or division, will produce a similar change in the quotient.

To multiply or divide both divisor and dividend by the same number does not change the value of the quotient.

BUSINESS EXERCISES.

379. A bin containing 237 bushels of wheat is sold for \$272.55. How much a bushel is it sold for?

380. If \$448 is paid for 28 tons of hay, what is the price per ton?

381. What is the price per pound when 160 pounds of mutton cost \$14.40?

382. If 33 tons of coal cost \$206.25, what is the price of one ton?

383. How many pounds of sugar can be bought for \$720 at 8 cents a pound?

384. The cost of a piece of cloth was \$112.70, and the price \$2.45 a yard. How many yards in the piece?

385. A farm containing 157 acres was sold for \$4474.50. What was the price per acre?

386. How many cows, at \$43 a head, will \$19,608 buy?

387. In a pile of 89,856 bricks how many loads are there, each load containing 1248 bricks?

388. A grocer paid \$37.52 for 536 pounds of sugar. How much did he pay for each pound?

389. When flour is worth \$5.75 a barrel, how many barrels can be bought for \$1161.50?

390. If \$71,428.35 be divided equally among seven persons, what will be the share of each?

391. A bookseller buys seven dozen slates for \$7.56. How much does he pay for each slate?

392. A fruit dealer buys 31 dozen oranges for \$7.44. How much does he pay for each orange?

393. An exhibition is visited by 12,804 persons during six days of a week. What is the average daily attendance?

394. The weekly wages of 231 men is \$1732.50. How much a day does each man receive?

395. A merchant pays \$7174 for 422 overcoats. At how much each must he sell them to gain \$1266?

396. A butcher pays \$119.25 for 159 turkeys. At how much a pair must he sell them to gain \$39.75?

397. How many bales, each weighing 475 pounds, can be made from 94,050 pounds of cotton?

398. At \$71 each, how many village lots can be bought for \$1,491,213?

WRITTEN DRILL EXERCISES.

399. Divide 20100120421 by 102003. Prove the correctness of your answer.

400. The divisor is 2034 and the quotient 843. If the divisor were 6102, what would the quotient be?

401. The divisor is 71421 and the quotient 403. If the divisor were 10203, what would the quotient be?

402. If the divisor were 5 times as large, the quotient would be 32701. What is the quotient?

403. If the divisor were half what it is, the quotient would be 848. What is the quotient?

404. When the dividend is 10824 the quotient is 12. If the dividend were three times as large, what would the quotient be?

405. The quotient is 30201. What would the quotient be if both divisor and dividend were multiplied by 7?

406. The quotient is 6201. What would the quotient be if both divisor and dividend were divided by 11?

407. How many barrels of flour can be bought for \$2984 at \$8 a barrel?

408. What number multiplied by 12 will give the same product as 1452 multiplied by 1001?

409. $2042005602 \div 103$. Prove the work.

410. Divide 20563124 by 63, using factors.

411. What number must be taken from 204205 that it may be exactly divisible by 27?

412. How many bushels of oats at 56 cents a bushel can be bought for \$132.72?

413. Divide the product of 42156 and 10020 by the difference between 109901 and 109889.

414. Divide 19094867 by 4009. Prove the work.

415. How many *sevens* must we add together to get 819?

416. The dividend is 74198, the quotient is 2005, and the remainder is 24 less than the divisor. What is the divisor?

417. Multiply 24004005 by 1155, and divide the product by 5, 3, 7, and 11.

418. If 35 be added to a certain number it will contain 53 1367 times. What is the number?

V. REVIEW.

LOSS AND GAIN EXERCISES.

419. A man bought 225 acres of land at \$15 an acre, and sold the whole for \$3125; how much did he gain or lose?

NOTE.—The difference between the cost of anything and the price at which it is sold is a **gain** or a **loss**—a gain when the selling price is the greater, and a loss when the cost is the greater.

420. Bought a farm for \$2617, and sold it for \$2199; what did I lose?

421. Bought 246 barrels of flour at \$5.50 a barrel, and sold the whole for \$1467; how much did I gain or lose?

422. Bought 317 bushels of wheat for \$421, and sold the whole at 95 cents a bushel; how much did I lose?

423. Bought a farm of 155 acres, at \$42.40 an acre, and sold the same for \$7195; what did I gain or lose?

424. Bought a farm for \$3695; spent \$947 in improvements; sold out for \$4267; how much did I lose?

425. A farmer bought 30 cows for \$540 ; he fed them for one year at a cash expense of \$7.50 per head ; he then sold the entire herd for \$870 ; how much did he gain or lose ?

426. Bought a house and lot for \$2127 ; built an addition to the house at an expense of \$365 ; sold out for \$2598 ; how much did I gain or lose ?

427. Bought a fishing boat for \$195 ; spent \$35 for painting and repairs ; received \$42 for the use of the boat ; sold out for \$212 ; how much did I gain ?

428. A newsboy buys 144 newspapers each day at 20 cents a dozen. He sells them at 3 cents each. At the end of the week he has 18 old papers on hand. How much money has he made during the week ?

429. A man rented a skating rink for three weeks at \$95 a week. His expenses for heat and light were \$1.75 a day for 18 days. He charged 25 cents for adults, and 15 cents for children. The total attendance of the former was 3254, and of the latter 2106. How much did he gain ?

430. A merchant bought 120 overcoats at \$15.85 each. He sold half of them at \$25 each, and the others he sold in a job lot for \$820. How much did he gain or lose ?

431. A book agent bought 90 books at \$2.75 each. He sold them at \$5 each. His expenses were \$12.25. He was unable to collect for three books. How much did he gain or lose ?

432. A fruit dealer buys 242 dozen oranges at 13 cents a dozen ; 104 oranges are spoiled ; he sells the others at the rate of 14 for 25 cents. How much does he gain ?

433. A farmer bought a ten-acre field of ripe wheat for \$175. He paid \$1.35 an acre for cutting and saving, 3 cents a bushel for thrashing and cleaning, and \$2 a load (42 bushels) for teaming. The wheat yielded 21 bushels to the acre, and was sold for \$1.35 a bushel. How much did the farmer gain or lose ?

MISCELLANEOUS EXERCISES.

434. Find the sum of all the numbers between 897 and 904.
435. There are 27 boys in a class ; a certain boy's number is 13 when the class numbers from the right. What number has he when they number from the left ?
436. Divide 26050432105 by 132, using factors.
437. A steamboat can run 10 miles an hour down a river, and 8 miles an hour up. After running down the river for 24 hours, how long will she be in returning ?
438. If 49 be added 101 times to itself, by how much will the result fall short of 5000 ?
439. How many times must 720 be added to 522 to make 987642 ?
440. What number must be added to 32684 to make it exactly divisible by 126 ?
441. What number must be subtracted from 461633 to make it exactly divisible by 758 ?
442. How many times must 12 be subtracted from 600455 to leave 11 ?
443. My fare from Hamilton to Montreal, at 3 cents a mile, was \$11.55. I returned by boat at one cent less a mile. What was my fare for the round trip ?
444. By what number must 14212 be divided so that the result may be as much above 692 as it is below 804 ?
445. If 29 be added to a certain number, 87 may be subtracted from it 91 times. Find the number.
446. I have a coin, and on it is stamped MDCIV. In what year was it made ?
447. A boy drives the cows twice a day to be milked ; how many times will he have driven them during the months of June, July and August ?

448. I bought 7 cows at \$37 each. At how much a head must I sell them to gain \$35?

449. What is the largest number that can be taken 314 times from the product of 8652 and 37 so as to leave a remainder of 292806?

450. How long a string will it take to go round a house 42 feet long and 36 feet wide?

451. Find the sum of all the numbers ending with 8 or 9 between 700 and 800.

452. Find the number which subtracted from 900000 leaves 751936.

453. Multiply the sum of 86297 and 40025 by the difference between 789 and 694.

454. A drover bought 84 head of cattle at \$21 each, and sold them at \$28 each; how much did he gain?

455. Multiply 2010500401 by 30102.

456. When 11 has been added 19 times to a certain number the result is 33 less than 12 times the original number. What is the original number?

457. When 300 is added to a certain number the result is 75 more than 4 times the number. Find the number.

458. Which is the nearer number to 100010 : 200009 or 11?

459. Bought 45 head of cattle at \$24 each, and paid \$500 cash, and the remainder in sheep at \$4 a head; how many sheep were required to balance the debt?

460. A man paid \$3750 for some village property, which was \$1243 less than he paid for a farm; what did he pay for both?

461. Find the sum of the five largest numbers that can be expressed by the figures 9, 8, 0, 4, and 2.

462. A mechanic earns \$90 a month; his expenses are \$784 a year; how long will it take him to save enough to buy a house worth \$2960?

463. A farmer's wife sold a grocer 15 dozen eggs at 14 cents, and 27 pounds of butter at 22 cents ; she received in payment 12 pounds of sugar at 11 cents, and cash for the balance. How much cash did she get ?

464. A man bought an equal number of apples and oranges for \$11.25 ; for the apples he paid 2 cents each, and for the oranges 3 cents each ; how many of each did he buy ?

465. Two men start from the same place and travel in opposite directions, one at the rate of 3 miles an hour and the other at the rate of 4 miles an hour ; how far apart will they be in 240 hours ?

466. I bought a house for \$4500 ; spent \$1263 in improvements, and then sold it for \$6225 ; how much did I gain ?

467. If any number be doubled, the result increased by 1, the sum multiplied by 3, the product diminished by 9, and the remainder divided by 6, the quotient will be less by unity than the number taken at first. Why ?

468. How many times may the difference between 2184 and 7692 be taken from 8 times the sum of 56213 and 49439 so as to leave a remainder of 24524 ?

469. The divisor is 63875, the quotient 46938, and the remainder the largest whole number possible. Find the dividend.

470. A railway charges a cent a mile for the first fifty miles for carrying a cord of wood, and then 3 cents for every 4 miles beyond the fifty. What will it cost to carry 250 cords 90 miles ?

471. Find the difference between the sum of 73927 and 8496 and the product of 1987 and 39.

472. Of what number is 7589 both divisor and quotient ?

473. A farmer has an orchard containing 580 trees ; each tree produces 3 barrels of apples ; how much are the apples worth at \$1.25 a barrel ?

474. What number added to the sum of all the numbers that end in 7 between 1 and 150 will make a million ?

475. I bought 28 pounds of rice at 9 cents, 12 pounds of sugar at 11 cents, 4 pounds of tea at 75 cents, and three lemons at 3 cents each. What change should I receive if I give a ten-dollar bill in paying ?

476. If a clerk receives \$640 a year, and his expenses are \$325 a year, how many years will it take him to pay for a 56-acre farm at \$45 an acre ?

477. In how many days will a clock strike 2652 strokes ?

478. A laborer receives \$22 a month and board for 8 months of the year ; the rest of the year he is idle and pays \$14 a month for board ; allowing him \$35 a year for other expenses, how much should he save in 3 years ?

479. A merchant bought 26 pieces of broadcloth, each containing 53 yards, at \$4 a yard ; how much did the whole cost him ?

480. Divide 318493428 by 8607.

481. Two persons start from the same point to travel in opposite directions ; one travels 26 miles a day, and the other 35 miles a day ; how far apart will they be at the end of 45 days ?

482. What number must be added 29 times to 465 to make the sum equal to 1799 ?

483. What number must be taken 38 times from the sum of 864, 923 and 638 to leave 297 ?

484. The product of two numbers is 588 ; one of the numbers is 12 times the other. What are they ?

485. A farmer traded two old stoves, weighing together 572 pounds, for a new stove worth \$27.50 ; the stove dealer allowed him 3 cents a pound for the old stoves ; how much cash should the farmer pay ?

486. A postman called at every second house on a street ; at half the houses at which he called he delivered 2 letters, and at the other half, one letter each ; he delivered in all 360 letters. How many houses on the street ?

487. The dividend is 2547346, the quotient 254, the remainder 2654 less than the divisor. Find the divisor.

488. A man bought on speculation 68 horses at \$84 each ; 11 of them die ; at how much each must he sell the others to gain \$444 ?

489. What is the sum of the ages in 1886 of four persons who were born in 1775, 1793, 1819 and 1832 ?

490. One train left Chicago at 3 p.m. at 28 miles an hour ; a second train left at 5 p.m. at 36 miles an hour ; when will the fast overtake the slow, and how far from Chicago ?

491. It is found that if 593 be subtracted 347 times from a certain number the remainder is 287. Find the certain number.

492. Find the number such that if it be added 56 times to 29483 the sum will be 238027.

493. A carpenter earned \$63 by working a certain number of days ; if he had worked 13 days more he would have earned \$102. Find his daily wages.

494. A farmer has 834 trees in two orchards ; he has 142 more in one than in the other. How many has he in each ?

495. A house and lot cost \$8358 ; the house cost 6 times as much as the lot. Find the cost of each.

496. If a sheep gives 8 pounds of wool in a year, how many pounds can be got from 36 sheep in 4 years, and what will it be worth at 38 cents a pound ?

497. In a certain school library there are 879 books, which number gives 29 books to each pupil and 9 books over. How many pupils are there ?

498. The sum of two numbers is 3785, and the greater is 249 more than the less. What are the numbers ?

499. At an election A and B were the only candidates ; the whole vote cast was 6235 ; A was elected by a majority of 647. How many votes did B get ?

500. The sum of two numbers is 4628 ; their difference is 228. What are the numbers ?

501. By what must you divide the sum of the digits to obtain 5 ?

502. What is the nearest number to 34792 that can be divided by 296 without a remainder ?

503. George Wilson has made 7072 chairs in 4 years, making each year 150 more than the preceding year. How many did he make each year ?

504. How much water must be added to 90 gallons of wine worth \$4 a gallon so that the mixture may be worth \$3 a gallon ?

505. A man spent \$160 for a horse, which was \$110 less than three times as much as he paid for his buggy ; and his buggy cost \$6 more than 4 times the price of the harness. How much did the harness cost ?

506. When 402 is taken from a certain number, and the remainder is divided by 5, the quotient obtained is 42021. What is the number ?

507. A ton of coal lasts a family 14 days ; if coal is worth \$5.25 a ton, what will their coal cost from October 1, 1885, till March 31, 1886, inclusive ?

508. What is the difference in value between 620 cords of wood at \$3.47 a cord, and 520 tons of coal at \$4.65 a ton ?

509. A purse contains ten-dollar bills, five-dollar bills, and one-dollar bills, an equal number of each ; when the tens are taken out \$42 remains ; when the fives are taken out \$77 remains : and when the ones are taken out \$105 remains. How many bills of each kind does the purse contain ?

510. You find an old book with the date MDCXLVII. printed at the bottom of the title page. In what year was it published ?

511. A grocer bought 15 tubs of butter, each containing 48 pounds, at 28 cents a pound, and sold the same at 35 cents a pound. What was his gain ?

512. A produce dealer bought 1488 bags of potatoes at \$1.22 a bag, and sold them at \$1.57 a bag. What did he gain ?

513. How many times in succession can 3589 be subtracted from 241462, and what will be the final remainder ?

514. What number added to 909900190 makes 3000000201 ?

515. A merchant gained \$7387 in two years ; he gained the second year \$1053 more than the first. What was his gain each year ?

516. How many pounds of tea at 78 cents a pound must be given for 375 bushels of wheat at \$1.56 a bushel ?

517. What number must be taken from 20010032 so that it may be exactly divisible by 909 ?

518. What number besides 137 will exactly divide 11371 ?

519. The President of the United States receives \$50,000 a year. If he received \$5 more a year, how much would he receive a day ?

520. How many times can 1440 be subtracted from 8235460800 ?

521. When 9 is added to the dividend the quotient is 39, and when 2 is subtracted from the dividend the quotient is 38. What is the dividend ?

522. The quotient is 6 times the remainder. The divisor is 7 times the quotient. Find the dividend, the remainder being 45.

NOTE.—To find the average, divide the sum of the several numbers by the number of numbers.

523. Find the average of 263, 425, 373, 29, 47, 120, 263, 428, 32, and 40.

524. Find the average of \$22.35, \$68.42, \$33.21, \$16.80, \$15.65, and \$24.35.

525. What is the smallest number divisible by 7 which added to 3264 makes the sum divisible by 12 ?

526. The aggregate attendance at a public school during 157 days was 31,557. What was the average daily attendance ?

527. A merchant mixes 1 pound of tea worth 50 cents with 3 pounds worth 70 cents. What will a pound of the mixture be worth ?

528. A farmer mixes 12 bushels of oats worth 35 cents with 13 bushels of barley worth 60 cents. What is a bushel of the mixture worth ?

529. A grocer mixes 15 pounds of coffee worth 27 cents, 3 pounds worth 35 cents, and 3 pounds worth 40 cents. What is a pound of the mixture worth ?

530. A merchant's cash receipts for a week are \$231.14, \$125.63, \$632.84, \$321.15, \$424.17, and \$563.85. Find his daily average.

531. When 179 is added to the dividend the quotient is 237, and when 253 is subtracted from the dividend the quotient is 233. What is the divisor ?

532. For each dollar bill that I have, I have five silver half-dollars ; and for each silver half-dollar that I have, I have 27 five-cent pieces. I have \$51.25 in all. How many five-cent pieces have I ?

533. Find a number to which if 369 be added the sum will be 1001 less than 9090.

534. If 54 clerks receive \$7776 for 16 weeks' work, how much a day does each receive ?

535. Two men had \$7583 divided between them ; the difference between their shares was \$223. What did each get ?

536. A has 11 times and C 25 times as much money as B. The difference between A's money and C's money is \$472.50. How much money has B ?

537. A farmer's horses, cattle and sheep together number 96. He has three times as many cattle as horses, and 4 times as many sheep as cattle. How many of each has he ?

SECOND DEPARTMENT.

I. FACTORS AND MULTIPLES.

HINTS AND DEFINITIONS.

An **integer** is a number that represents *whole* things.

An **even number** is a number exactly divisible by 2.

An **odd number** is a number not exactly divisible by 2.

The **factors** of a number are the integers whose product will equal the number. Thus 2 and 3 are the factors of 6; 5 and 7 are the factors of 35; 3, 2, and 11 are the factors of 66.

A **prime number** is a number exactly divisible by only itself and *one*. Thus 3, 5, 7, 11, 13, and 17 are prime numbers.

A **composite number** is a number that has other factors or divisors than itself and *one*.

A **prime factor** is any prime number used as a *factor*.

A **common factor** of two or more numbers is a number that will exactly divide each of the given numbers. Thus 9 is a common factor of 27 and 63, or of 36 and 72.

The **highest common factor** of two or more numbers is the largest number that will exactly divide each of the given numbers.

A **multiple** of a number is an exact dividend of that number. Thus 36 is a multiple of 3, or 6, or any number that will divide it exactly.

A **common multiple** of two or more numbers is any number that is exactly divisible by each of them. Thus 20 is a common multiple of 4 and 5.

The **least common multiple** of two or more numbers is the least number that is exactly divisible by each of them.

Any number is divisible by 3 if the sum of its digits is divisible by 3.

Any number is divisible by 4 if it end with two or more ciphers, or if the number expressed by its two right-hand figures be divisible by 4.

Any number is divisible by 5 if its right-hand figure be 5 or 0.

Any number is divisible by 9 if the sum of its digits be divisible by 9.

Any number is exactly divisible by 7, 11, and 13, if the units' period and the thousands' period are the same.

The product of all the prime factors of a number is equal to that number.

The product of the greatest common measure and least common multiple of two numbers is equal to the product of the two numbers.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

1. Find the sum of the even numbers between 1 and 15.
2. Find the sum of the odd numbers between 2 and 14.
3. Find the sum of all the prime factors of 210.
4. Name the prime numbers from 1 to 30.
5. Name the largest prime number expressed by two figures.
6. Name the smallest prime number expressed by three figures.
7. Find the sum of the six smallest prime numbers.
8. Find the sum of the seven smallest composite numbers.
9. What is the highest common factor of 21, 28, and 35?
10. What is the least common multiple of 3, 5, and 7?

WRITTEN DRILL EXERCISES.

11. What are the prime factors of 390? 495? 968?
12. What are the prime factors of 756? 1089? 8064?
13. What are the prime factors of 1728? 3465? 3003?
14. What are the prime factors of 4158? 3150? 2310?
15. What are the prime factors of 6552? 7826? 5368?
16. What are the prime factors of 5075? 9576? 1155?
17. What is the sum of the prime factors of 34650?
18. What is the sum of the prime factors of 172800?
19. Find the prime factors common to 144 and 180.
20. Find the prime factors common to 462 and 440.
21. Find the prime factors common to 168, 256, and 320.
22. Find the prime factors common to 325, 540, and 635.

23. What is the largest prime factor common to 1561 and 1477?
24. What is the largest prime factor common to 385 and 735?
25. What is the greatest common divisor of 272 and 425?
26. What is the greatest common divisor of 394 and 672?
27. What is the greatest common divisor of 825 and 960?
28. What is the greatest common divisor of 2121 and 1313?
29. What is the greatest common divisor of 348, 609, and 580?
30. What is the largest multiple of 3 and 5 that can be expressed by three figures?
31. What is the smallest multiple of 2 and 7 that can be expressed by three figures?
32. What is the largest multiple of 5 and 7 that can be expressed by four figures?
33. What is the smallest multiple of 2, 3, and 5 that can be expressed by three figures?
34. What is the largest multiple of 3, 5, and 7 that can be expressed by three figures?
35. What is the least number of which 2, 3, and 5 are factors?
36. What is the least number of which 3, 5, and 7 are factors?
37. What is the least number of which 2, 3, 5, and 7 are factors?
38. What is the least number of which 3, 4, 5, 6, and 8 are factors?
39. Find the least common multiple of 3, 5, 6, 7, and 8.
40. Find the least common multiple of 4, 5, 9, 12, 15, and 20.
41. Find the least common multiple of 10, 16, 24, 40, and 64.
42. Find the least number which, divided by 3, 7, 11, or 13, will give a remainder of 2 in each case.
43. Find the greatest number that will divide 748 and 927 and give the remainders 13 and 17 respectively.

44. Find the sum of all the prime numbers between 10 and 100.

45. What is the smallest prime number that can be expressed by four figures?

NOTE.—L. C. M. stands for “least common multiple,” and H. C. F. for “highest common factor.”

46. The L. C. M. of 391 and another number is 12121, and the H. C. F. is 23. What is the other number?

47. The product of the H. C. F. and L. C. M. of two numbers is 1728; one of the numbers is 96. Find the other.

48. The sum of two numbers is 550; their common factor is 11; the difference between the other two factors is 12. What are the numbers?

49. The sum of two numbers is 686; their common factor is 7; the difference between the other two factors is 16. What are the numbers?

II. COMMON FRACTIONS.

HINTS AND DEFINITIONS.

A **fraction** is one or more of the equal parts of a unit.

A fraction is usually expressed by two numbers, one written above the other, with a line between.

The **denominator** of a fraction is the number written below the line, and shows the number of equal parts into which the unit is divided.

The **numerator** of a fraction is the number written above the line, and shows how many of the equal parts are used.

A **mixed number** is a whole number and a fraction united.

Multiplying the numerator, or dividing the denominator, multiplies the value of a fraction.

Dividing the numerator, or multiplying the denominator, divides the value of a fraction.

Multiplying or dividing both terms by the same number does not change the value of a fraction.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

50. In 3 *fourths* how many *sixteenths*?
51. One third of a year is how many *sixths* of a year?
52. Two thirds of a mile are how many *ninths* of a mile?
53. Four fifths of a month are how many *fifteenths* of a month?
54. Express three of the seven equal parts of a unit.
55. Express seven of the twelve equal parts of a unit.
56. How many *thirds* in 5?
57. In 18 units how many *fourths*?
58. Reduce $\frac{3}{4}$ to a fraction whose denominator is 32.
59. Change $\frac{7}{12}$ to an equivalent fraction having 60 for its denominator.

WRITTEN DRILL EXERCISES.

DIRECTION.—The twenty-five fractions which follow are to be reduced to their lowest terms.

- | | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| 60. $\frac{6}{8}$. | 65. $\frac{32}{48}$. | 70. $\frac{28}{42}$. | 75. $\frac{64}{96}$. | 80. $\frac{72}{128}$. |
| 61. $\frac{3}{9}$. | 66. $\frac{45}{60}$. | 71. $\frac{34}{85}$. | 76. $\frac{25}{75}$. | 81. $\frac{85}{105}$. |
| 62. $\frac{10}{12}$. | 67. $\frac{48}{64}$. | 72. $\frac{36}{81}$. | 77. $\frac{48}{84}$. | 82. $\frac{90}{135}$. |
| 63. $\frac{12}{16}$. | 68. $\frac{63}{81}$. | 73. $\frac{25}{30}$. | 78. $\frac{27}{90}$. | 83. $\frac{18}{44}$. |
| 64. $\frac{18}{24}$. | 69. $\frac{24}{36}$. | 74. $\frac{44}{48}$. | 79. $\frac{44}{55}$. | 84. $\frac{96}{108}$. |

DIRECTION.—The twenty-five mixed numbers which follow are to be reduced to fractional form, with numerator and denominator only.

- | | | | | |
|-----------------------|------------------------|----------------------|-----------------------|------------------------|
| 85. $27\frac{1}{2}$. | 90. $13\frac{1}{8}$. | 95. $3\frac{3}{5}$. | 100. $4\frac{4}{5}$. | 105. $7\frac{3}{10}$. |
| 86. $32\frac{1}{4}$. | 91. $29\frac{1}{6}$. | 96. $2\frac{2}{3}$. | 101. $6\frac{7}{8}$. | 106. $8\frac{4}{11}$. |
| 87. $43\frac{1}{3}$. | 92. $40\frac{1}{9}$. | 97. $4\frac{3}{4}$. | 102. $7\frac{7}{9}$. | 107. $5\frac{3}{13}$. |
| 88. $18\frac{1}{5}$. | 93. $82\frac{1}{10}$. | 98. $5\frac{2}{5}$. | 103. $8\frac{3}{7}$. | 108. $6\frac{5}{12}$. |
| 89. $16\frac{1}{7}$. | 94. $63\frac{1}{11}$. | 99. $6\frac{3}{8}$. | 104. $9\frac{5}{8}$. | 109. $9\frac{7}{20}$. |

DIRECTION.—The thirty-five fractions which follow are to be reduced to mixed numbers.

110. $\frac{12}{5}$.	117. $\frac{51}{7}$.	124. $\frac{101}{2}$.	131. $\frac{375}{4}$.	138. $\frac{1005}{8}$.
111. $\frac{13}{3}$.	118. $\frac{63}{10}$.	125. $\frac{103}{3}$.	132. $\frac{376}{3}$.	139. $\frac{2006}{5}$.
112. $\frac{18}{5}$.	119. $\frac{82}{7}$.	126. $\frac{111}{4}$.	133. $\frac{427}{12}$.	140. $\frac{1013}{4}$.
113. $\frac{19}{4}$.	120. $\frac{43}{3}$.	127. $\frac{115}{7}$.	134. $\frac{303}{16}$.	141. $\frac{2068}{17}$.
114. $\frac{17}{2}$.	121. $\frac{32}{11}$.	128. $\frac{123}{5}$.	135. $\frac{444}{5}$.	142. $\frac{3046}{19}$.
115. $\frac{21}{4}$.	122. $\frac{75}{12}$.	129. $\frac{192}{11}$.	136. $\frac{518}{9}$.	143. $\frac{1098}{21}$.
116. $\frac{42}{5}$.	123. $\frac{37}{6}$.	130. $\frac{133}{10}$.	137. $\frac{873}{4}$.	144. $\frac{6001}{23}$.

NOTE.—In order that fractions may be added they must have like denominators and be parts of like units.

145. $\frac{1}{2} + \frac{1}{3}$.	155. $\frac{1}{3} + \frac{1}{7}$.	165. $\frac{1}{2} + \frac{2}{3}$.	175. $\frac{3}{8} + \frac{3}{7}$.
146. $\frac{1}{2} + \frac{1}{4}$.	156. $\frac{1}{4} + \frac{1}{5}$.	166. $\frac{1}{3} + \frac{3}{4}$.	176. $\frac{3}{8} + \frac{2}{3}$.
147. $\frac{1}{2} + \frac{1}{5}$.	157. $\frac{1}{4} + \frac{1}{7}$.	167. $\frac{2}{3} + \frac{3}{4}$.	177. $\frac{3}{8} + \frac{1}{10}$.
148. $\frac{1}{2} + \frac{1}{6}$.	158. $\frac{1}{5} + \frac{1}{9}$.	168. $\frac{2}{3} + \frac{3}{5}$.	178. $\frac{2}{3} + \frac{5}{12}$.
149. $\frac{1}{2} + \frac{1}{7}$.	159. $\frac{1}{5} + \frac{1}{8}$.	169. $\frac{2}{3} + \frac{4}{5}$.	179. $\frac{3}{7} + \frac{2}{11}$.
150. $\frac{1}{2} + \frac{1}{8}$.	160. $\frac{1}{6} + \frac{1}{9}$.	170. $\frac{1}{2} + \frac{3}{5}$.	180. $\frac{4}{7} + \frac{5}{11}$.
151. $\frac{1}{2} + \frac{1}{9}$.	161. $\frac{1}{3} + \frac{1}{11}$.	171. $\frac{1}{2} + \frac{4}{5}$.	181. $\frac{3}{10} + \frac{7}{12}$.
152. $\frac{1}{3} + \frac{1}{4}$.	162. $\frac{1}{6} + \frac{1}{11}$.	172. $\frac{3}{4} + \frac{3}{5}$.	182. $\frac{5}{16} + \frac{3}{4}$.
153. $\frac{1}{3} + \frac{1}{5}$.	163. $\frac{1}{2} + \frac{1}{11}$.	173. $\frac{3}{4} + \frac{4}{5}$.	183. $\frac{2}{10} + \frac{4}{5}$.
154. $\frac{1}{3} + \frac{1}{6}$.	164. $\frac{1}{3} + \frac{1}{12}$.	174. $\frac{3}{4} + \frac{2}{5}$.	184. $\frac{1}{13} + \frac{19}{20}$.

NOTE.—The small figures to the right of the numbers below represent *fourths*. Thus $48^2 = 48\frac{1}{4}$ or $48\frac{1}{2}$. This method of writing small fractions is frequently made use of by business men.

185. Add 24^2 , 25 , 26^1 , 27^3 , 29^3 , 28^2 , 24 , 23^2 , 27^3 , and 29^2 .
186. Add 29^3 , 22^2 , 27^3 , 29^2 , 22^3 , 21^3 , 26^3 , 28^1 , 25^1 , and 32^3 .
187. Add 49^2 , 54^2 , 48^2 , 47^2 , 56^3 , 51^3 , 52 , 48 , 47^2 , and 46^1 .
188. Add 73^1 , 72^2 , 73^3 , 74^3 , 75^2 , 76^3 , 77^1 , 72^2 , 73^2 , and 74^2 .
189. Add 64^1 , 62^2 , 63 , 64^2 , 65^3 , 62^1 , 66^2 , 64^3 , 62^1 , and 63^2 .

DIRECTION.—In adding the fractions in the first column below, add the first two fractions, then add their sum and the third fraction. Do not use pen or pencil.

190. $\frac{1}{2} + \frac{1}{3} + \frac{1}{6}.$

205. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8}.$

191. $\frac{1}{4} + \frac{1}{3} + \frac{5}{12}.$

206. $\frac{2}{3} + \frac{1}{2} + \frac{2}{5} + \frac{1}{3} + \frac{1}{5} + \frac{3}{4} + \frac{1}{7}.$

192. $\frac{1}{5} + \frac{1}{3} + \frac{7}{15}.$

207. $\frac{1}{3} + \frac{3}{5} + \frac{1}{2} + \frac{3}{4} + \frac{4}{5} + \frac{1}{8} + \frac{3}{8}.$

193. $\frac{1}{5} + \frac{1}{4} + \frac{11}{20}.$

208. $\frac{7}{8} + \frac{1}{3} + \frac{1}{7} + \frac{3}{4} + \frac{5}{6} + \frac{3}{7} + \frac{2}{3}.$

194. $\frac{2}{5} + \frac{1}{3} + \frac{4}{15}.$

209. $\frac{1}{2} + \frac{1}{3} + \frac{1}{3} + \frac{1}{4} + \frac{3}{4} + \frac{1}{5} + \frac{1}{20}.$

195. $\frac{3}{4} + \frac{2}{5} + \frac{17}{20}.$

210. $\frac{3}{7} + \frac{2}{3} + \frac{4}{5} + \frac{6}{7} + \frac{1}{9} + \frac{1}{4} + \frac{1}{15}.$

196. $\frac{3}{5} + \frac{2}{3} + \frac{11}{15}.$

211. $\frac{5}{8} + \frac{1}{6} + \frac{7}{8} + \frac{3}{4} + \frac{4}{5} + \frac{6}{7} + \frac{7}{10}.$

197. $\frac{3}{5} + \frac{3}{4} + \frac{13}{20}.$

212. $\frac{4}{9} + \frac{2}{3} + \frac{5}{6} + \frac{5}{9} + \frac{1}{2} + \frac{1}{6} + \frac{11}{18}.$

198. $\frac{4}{5} + \frac{1}{3} + \frac{13}{15}.$

213. $\frac{1}{2} + \frac{1}{5} + \frac{3}{4} + \frac{1}{3} + \frac{1}{6} + \frac{9}{10} + \frac{1}{12}.$

199. $\frac{4}{5} + \frac{3}{4} + \frac{9}{20}.$

214. $\frac{3}{5} + \frac{1}{4} + \frac{1}{2} + \frac{1}{3} + \frac{5}{6} + \frac{9}{10} + \frac{1}{20}.$

200. $\frac{2}{7} + \frac{1}{3} + \frac{8}{21}.$

215. $\frac{1}{3} + \frac{3}{7} + \frac{3}{4} + \frac{1}{6} + \frac{1}{2} + \frac{5}{12} + \frac{4}{21}.$

201. $\frac{3}{8} + \frac{2}{3} + \frac{23}{24}.$

216. $\frac{2}{3} + \frac{5}{6} + \frac{3}{4} + \frac{1}{2} + \frac{3}{5} + \frac{5}{12} + \frac{1}{24}.$

202. $\frac{4}{7} + \frac{3}{11} + \frac{17}{77}.$

217. $\frac{4}{5} + \frac{3}{5} + \frac{3}{4} + \frac{1}{2} + \frac{2}{11} + \frac{7}{10} + \frac{3}{20}.$

203. $\frac{3}{4} + \frac{5}{6} + \frac{5}{12}.$

218. $\frac{2}{5} + \frac{3}{8} + \frac{4}{5} + \frac{7}{8} + \frac{1}{12} + \frac{11}{20} + \frac{17}{20}.$

204. $\frac{7}{12} + \frac{1}{11} + \frac{43}{132}.$

219. $\frac{4}{5} + \frac{3}{7} + \frac{1}{2} + \frac{1}{3} + \frac{19}{35} + \frac{14}{21} + \frac{13}{15}.$

NOTE.—In adding mixed numbers add the fractions first, and to their sum add the sum of the whole numbers.

220. $2\frac{1}{2} + 3\frac{1}{4}.$

225. $5\frac{2}{3} + 3\frac{1}{2}.$

230. $2\frac{1}{3} + \frac{1}{2}.$

235. $10\frac{1}{2} + 3\frac{1}{9}.$

221. $3\frac{1}{3} + 2\frac{1}{2}.$

226. $4\frac{2}{3} + 5\frac{1}{3}.$

231. $3\frac{1}{4} + \frac{1}{3}.$

236. $11\frac{1}{3} + 4\frac{1}{4}.$

222. $3\frac{1}{4} + 5\frac{1}{3}.$

227. $6\frac{4}{5} + 2\frac{1}{8}.$

232. $4\frac{1}{5} + \frac{1}{4}.$

237. $12\frac{3}{11} + 2\frac{1}{3}.$

223. $8\frac{1}{5} + 3\frac{1}{2}.$

228. $3\frac{1}{5} + 4\frac{1}{8}.$

233. $3\frac{1}{7} + \frac{2}{3}.$

238. $13\frac{4}{7} + 1\frac{3}{11}.$

224. $4\frac{1}{2} + 5\frac{1}{4}.$

229. $4\frac{1}{7} + 5\frac{1}{6}.$

234. $4\frac{1}{9} + \frac{3}{5}.$

239. $18\frac{2}{5} + 1\frac{5}{9}.$

240. Add $101\frac{1}{2}$, $305\frac{1}{3}$, $402\frac{1}{4}$, $361\frac{1}{5}$, and $222\frac{2}{3}$.

241. Add $35\frac{1}{3}$, $624\frac{3}{4}$, $620\frac{1}{2}$, $1013\frac{2}{3}$, and $1056\frac{1}{4}$.

242. Add $6510\frac{2}{3}$, $2004\frac{3}{5}$, $6\frac{1}{2}$, $3005\frac{1}{3}$, and $113\frac{1}{6}$.

243. Add $35\frac{1}{2}$, $621\frac{5}{12}$, $324\frac{5}{6}$, $302\frac{2}{3}$, $463\frac{1}{4}$, and $2015\frac{1}{2}\frac{9}{4}$.

NOTE.—In order that fractions may be subtracted they must have like denominators and be parts of like units.

244. $\frac{2}{3} - \frac{1}{2}$.	249. $\frac{3}{5} - \frac{1}{2}$.	254. $\frac{1}{2} - \frac{1}{5}$.	259. $\frac{5}{12} - \frac{1}{4}$.
245. $\frac{3}{4} - \frac{1}{3}$.	250. $\frac{5}{6} - \frac{2}{3}$.	255. $\frac{1}{3} - \frac{1}{5}$.	260. $\frac{7}{12} - \frac{2}{3}$.
246. $\frac{2}{3} - \frac{1}{5}$.	251. $\frac{5}{6} - \frac{2}{5}$.	256. $\frac{3}{5} - \frac{1}{7}$.	261. $\frac{5}{7} - \frac{3}{11}$.
247. $\frac{3}{4} - \frac{1}{5}$.	252. $\frac{5}{6} - \frac{3}{4}$.	257. $\frac{3}{4} - \frac{1}{7}$.	262. $\frac{19}{20} - \frac{4}{5}$.
248. $\frac{4}{5} - \frac{1}{3}$.	253. $\frac{3}{4} - \frac{1}{6}$.	258. $\frac{2}{3} - \frac{2}{5}$.	263. $\frac{3}{11} - \frac{1}{10}$.

264. $2\frac{1}{2} - 1\frac{3}{4}$.	267. $1\frac{3}{5} - \frac{3}{4}$.	270. $2\frac{1}{2} - \frac{1}{3}$.	273. $10\frac{2}{5} - 3\frac{1}{3}$.
265. $3\frac{1}{3} - \frac{4}{5}$.	268. $2\frac{4}{7} - \frac{2}{3}$.	271. $3\frac{1}{4} - 1\frac{2}{5}$.	274. $10\frac{7}{12} - 5\frac{4}{5}$.
266. $6\frac{3}{4} - 1\frac{1}{3}$.	269. $3\frac{1}{9} - \frac{4}{5}$.	272. $5\frac{6}{7} - 3\frac{2}{3}$.	275. $3\frac{1}{4} - 1\frac{2}{3}$.

276. $205\frac{3}{5} - 67$.	279. $222 - 35\frac{4}{5}$.	282. $364 - 199\frac{5}{8}$.
277. $324\frac{2}{3} - 48$.	280. $425 - 37\frac{1}{2}$.	283. $524 - 225\frac{5}{12}$.
278. $573\frac{1}{9} - 29$.	281. $625 - 68\frac{3}{4}$.	284. $312 - 195\frac{3}{5}$.

285. $346\frac{2}{3} - 42\frac{1}{2}$.	289. $291\frac{1}{3} - 14\frac{2}{5}$.	293. $212\frac{1}{2} - 112\frac{1}{3}$.
286. $402\frac{1}{2} - 13\frac{2}{3}$.	290. $363\frac{3}{4} - 18\frac{1}{2}$.	294. $403\frac{1}{4} - 314\frac{1}{2}$.
287. $624\frac{3}{5} - 62\frac{4}{5}$.	291. $424\frac{5}{6} - 82\frac{1}{4}$.	295. $562\frac{3}{4} - 421\frac{2}{3}$.
288. $225\frac{5}{6} - 13\frac{1}{3}$.	292. $321\frac{1}{5} - 81\frac{3}{4}$.	296. $628\frac{3}{8} - 219\frac{5}{6}$.

NOTE.—To multiply a fraction by a whole number, multiply the numerator or divide the denominator by that number.

297. $\frac{3}{4} \times 8$.	303. $\frac{3}{5} \times 16$.	309. $\frac{1}{2} \times 22$.	315. $\frac{1}{20} \times 4$.
298. $\frac{4}{5} \times 7$.	304. $\frac{5}{9} \times 18$.	310. $\frac{1}{3} \times 24$.	316. $\frac{3}{14} \times 2$.
299. $\frac{5}{6} \times 6$.	305. $\frac{4}{5} \times 20$.	311. $\frac{1}{4} \times 36$.	317. $\frac{8}{35} \times 7$.
300. $\frac{3}{4} \times 12$.	306. $\frac{8}{9} \times 27$.	312. $\frac{1}{8} \times 42$.	318. $\frac{1}{42} \times 6$.
301. $\frac{5}{7} \times 21$.	307. $\frac{2}{3} \times 15$.	313. $\frac{1}{9} \times 54$.	319. $\frac{10}{7} \times 8$.
302. $\frac{8}{9} \times 36$.	308. $\frac{3}{8} \times 17$.	314. $\frac{1}{10} \times 90$.	320. $\frac{1}{36} \times 8$.

NOTE.—When the multiplicand is a mixed number multiply the fraction and integer separately, and add the results.

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|--------------------------------|----------------------------------|-----------------------------------|
| 321. $5\frac{1}{2} \times 4$. | 331. $221\frac{1}{2} \times 4$. | 341. $201\frac{1}{2} \times 10$. |
| 322. $6\frac{2}{3} \times 5$. | 332. $362\frac{2}{3} \times 3$. | 342. $403\frac{2}{3} \times 12$. |
| 323. $8\frac{2}{3} \times 6$. | 333. $655\frac{2}{3} \times 6$. | 343. $621\frac{4}{9} \times 18$. |
| 324. $9\frac{3}{4} \times 8$. | 334. $421\frac{2}{3} \times 5$. | 344. $369\frac{1}{5} \times 25$. |
| 325. $4\frac{2}{5} \times 5$. | 335. $853\frac{1}{4} \times 8$. | 345. $624\frac{2}{3} \times 98$. |
| 326. $6\frac{3}{4} \times 6$. | 336. $321\frac{2}{3} \times 6$. | 346. $421\frac{1}{5} \times 47$. |
| 327. $9\frac{1}{2} \times 7$. | 337. $423\frac{1}{3} \times 4$. | 347. $328\frac{1}{3} \times 64$. |
| 328. $6\frac{2}{3} \times 8$. | 338. $630\frac{4}{5} \times 8$. | 348. $427\frac{2}{5} \times 86$. |
| 329. $7\frac{4}{5} \times 9$. | 339. $263\frac{3}{4} \times 5$. | 349. $625\frac{1}{4} \times 89$. |
| 330. $8\frac{3}{4} \times 3$. | 340. $100\frac{1}{4} \times 9$. | 350. $321\frac{1}{3} \times 25$. |

NOTE.—Multiply by the numerator of the fraction, and divide the product by the denominator. When the multiplier is a mixed number multiply by the fraction and integer separately, and add the results.

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|---------------------------------|----------------------------------|-----------------------------------|
| 351. $103 \times \frac{1}{2}$. | 357. $263 \times 2\frac{1}{2}$. | 363. $224 \times 21\frac{4}{5}$. |
| 352. $422 \times \frac{1}{3}$. | 358. $365 \times 3\frac{1}{3}$. | 364. $638 \times 42\frac{3}{8}$. |
| 353. $632 \times \frac{2}{3}$. | 359. $242 \times 4\frac{3}{4}$. | 365. $219 \times 32\frac{2}{3}$. |
| 354. $321 \times \frac{3}{4}$. | 360. $325 \times 5\frac{3}{5}$. | 366. $631 \times 19\frac{4}{7}$. |
| 355. $624 \times \frac{4}{5}$. | 361. $263 \times 3\frac{1}{8}$. | 367. $298 \times 32\frac{1}{8}$. |
| 356. $583 \times \frac{3}{8}$. | 362. $201 \times 5\frac{2}{7}$. | 368. $215 \times 18\frac{4}{9}$. |

NOTE.—Reduce mixed numbers to fractions; cancel all factors common to the numerators and denominators; multiply the remaining numerators for the numerator, and the remaining denominators for the denominator.

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| 369. $\frac{1}{2} \times \frac{2}{5} \times \frac{3}{4}$. | 375. $\frac{2}{3}$ of $12 \times \frac{3}{4}$ of $16 \times \frac{4}{5}$ of 20. |
| 370. $\frac{3}{8} \times \frac{2}{5} \times \frac{3}{4}$. | 376. $\frac{3}{5}$ of $15 \times \frac{3}{4}$ of $18 \times \frac{7}{9}$ of 21. |
| 371. $\frac{3}{5} \times \frac{4}{9} \times \frac{3}{4}$. | 377. $\frac{4}{5}$ of $18 \times \frac{3}{8}$ of $20 \times \frac{4}{9}$ of 27. |
| 372. $\frac{5}{8} \times \frac{3}{7} \times \frac{2}{3}$. | 378. $2\frac{1}{2} \times 3\frac{1}{3} \times \frac{1}{2}\frac{8}{5} \times \frac{3}{7} \times 4\frac{1}{6} \times \frac{1}{5}$. |
| 373. $\frac{2}{7} \times \frac{3}{4} \times \frac{1}{12}$. | 379. $3\frac{1}{3} \times \frac{3}{10} \times 4\frac{2}{5} \times \frac{3}{11} \times 3\frac{2}{3} \times 22$. |
| 374. $\frac{5}{13} \times \frac{1}{2}\frac{3}{5} \times \frac{1}{5}$. | 380. $8\frac{1}{4} \times \frac{10}{11} \times 3\frac{4}{5} \times \frac{1}{19} \times 4\frac{1}{2} \times \frac{1}{3}$. |

NOTE.—To divide a fraction by a whole number, divide the numerator or multiply the denominator by that number.

381. $\frac{3}{4} \div 8.$	384. $\frac{2}{3} \div 4.$	387. $\frac{4}{7} \div 3.$	390. $\frac{2}{3} \div 6.$
382. $\frac{4}{5} \div 2.$	385. $\frac{4}{9} \div 2.$	388. $\frac{3}{7} \div 4.$	391. $\frac{3}{8} \div 4.$
383. $\frac{5}{6} \div 5.$	386. $\frac{6}{7} \div 9.$	389. $\frac{4}{11} \div 9.$	392. $\frac{7}{9} \div 2.$

NOTE.—When the dividend is a mixed number divide the whole number and the fraction separately, and add the results.

393. $213\frac{1}{2} \div 4.$	403. $4210\frac{1}{7} \div 8.$	413. $263\frac{1}{2} \div 12.$
394. $321\frac{1}{3} \div 3.$	404. $2632\frac{7}{8} \div 2.$	414. $321\frac{1}{3} \div 18.$
395. $622\frac{1}{4} \div 5.$	405. $4021\frac{3}{8} \div 4.$	415. $420\frac{2}{5} \div 16.$
396. $220\frac{1}{2} \div 6.$	406. $3032\frac{3}{4} \div 3.$	416. $332\frac{3}{4} \div 22.$
397. $321\frac{1}{3} \div 8.$	407. $6200\frac{3}{7} \div 5.$	417. $601\frac{1}{2} \div 25.$
398. $101\frac{2}{5} \div 9.$	408. $2101\frac{1}{2} \div 3.$	418. $423\frac{1}{3} \div 18.$
399. $216\frac{1}{4} \div 7.$	409. $1021\frac{2}{3} \div 5.$	419. $632\frac{3}{4} \div 16.$
400. $321\frac{2}{5} \div 8.$	410. $6213\frac{4}{5} \div 6.$	420. $213\frac{3}{8} \div 19.$
401. $622\frac{3}{8} \div 5.$	411. $2631\frac{3}{5} \div 9.$	421. $212\frac{1}{4} \div 22.$
402. $400\frac{1}{4} \div 8.$	412. $2121\frac{4}{7} \div 2.$	422. $121\frac{1}{2} \div 30.$

NOTE.—To divide an integer, a fraction, or a mixed number by a fraction, invert the terms of the divisor and proceed as in multiplication; if by a mixed number, reduce the mixed number to a fraction before inverting the terms.

423. $\frac{3}{5} \div \frac{4}{5}.$	431. $12 \div \frac{1}{2}.$	439. $25 \div 2\frac{1}{2}.$	447. $18\frac{1}{2} \div 3\frac{1}{4}.$
424. $\frac{2}{3} \div \frac{3}{4}.$	432. $18 \div \frac{2}{3}.$	440. $38 \div 3\frac{1}{4}.$	448. $22\frac{1}{3} \div 8\frac{2}{5}.$
425. $\frac{5}{6} \div \frac{1}{2}.$	433. $16 \div \frac{3}{4}.$	441. $49 \div 2\frac{1}{5}.$	449. $33\frac{3}{4} \div 3\frac{1}{3}.$
426. $\frac{2}{3} \div \frac{3}{8}.$	434. $29 \div \frac{2}{5}.$	442. $68 \div 3\frac{3}{4}.$	450. $18\frac{1}{2} \div 2\frac{1}{2}.$
427. $\frac{5}{7} \div \frac{5}{6}.$	435. $18 \div \frac{3}{8}.$	443. $99 \div 2\frac{2}{3}.$	451. $27\frac{1}{4} \div 3\frac{1}{3}.$
428. $\frac{3}{10} \div \frac{2}{5}.$	436. $26 \div \frac{4}{5}.$	444. $87 \div 3\frac{1}{8}.$	452. $18\frac{2}{5} \div 3\frac{3}{5}.$
429. $\frac{3}{11} \div \frac{1}{2}.$	437. $29 \div \frac{2}{7}.$	445. $46 \div 1\frac{1}{2}.$	453. $16\frac{1}{9} \div 1\frac{1}{6}.$
430. $\frac{2}{19} \div \frac{2}{3}.$	438. $18 \div \frac{3}{5}.$	446. $28 \div 3\frac{3}{5}.$	454. $29\frac{1}{5} \div 1\frac{1}{2}.$

455. Change 32 to an equivalent fraction whose denominator is 32.

456. How many poor families can be supplied with $\frac{1}{8}$ of a ton of coal each from $7\frac{5}{8}$ tons?

457. The sum of three numbers is 84; the least is $4\frac{1}{2}$, the greatest $47\frac{3}{4}$. What is the product of the three?

458. What number diminished by $\frac{2}{5}$ of itself leaves a remainder of 240?

459. If $\frac{5}{9}$ of a mill is worth \$2500, what is $\frac{5}{9}$ of the mill worth?

460. The sum of two fractions is $1\frac{1}{11}$; one of them is $\frac{1}{3}$. What is the other?

461. What number diminished by $\frac{2}{5}$ of $\frac{3}{7}$ of itself leaves a remainder of 580?

462. If $\frac{5}{9}$ of a mill is worth \$5225, what is $\frac{3}{4}$ of the remainder worth?

463. Add $\frac{5}{8}$ of a dozen to $\frac{2}{5}$ of a hundred, and subtract the sum from $\frac{1}{2}\frac{9}{5}$ of a thousand.

464. A lady bought 3 pieces of cloth; the first contained $39\frac{1}{2}$ yards, the second $28\frac{1}{4}$ yards, and the third $25\frac{3}{8}$ yards. How many yards in all?

465. How many vests, each containing $\frac{3}{4}$ of a yard, can be made out of 24 yards?

466. If an acre of land is worth \$28, what is $\frac{3}{4}$ of an acre worth?

467. What fraction divided by $\frac{2}{3}$ of 12 will give $\frac{4}{5}$ for quotient?

468. A house and lot cost \$2400; the lot cost $\frac{1}{7}$ of what the house cost. Find the cost of each.

469. Multiply 200002 by $\frac{2}{3}$ and divide the product by $\frac{1}{2}$.

470. Divide 30103 by $\frac{2}{3}$ and multiply the quotient by $\frac{1}{2}$.

471. A man sold two houses for \$1200 each; on the one he gained $\frac{1}{3}$ of the cost price, and on the other he lost $\frac{1}{5}$ of the cost price. How much did he gain or lose on the two houses?

III. DECIMALS.

HINTS AND DEFINITIONS.

A **decimal fraction** expresses one or more of the *decimal* divisions of a unit.

Decimal fractions, commonly called *decimals*, are usually expressed by writing the numerator only.

The **decimal sign** (.) or point determines by its position the *denominator* of the fraction.

Annexing ciphers to a decimal does not alter its value.

Each removal of the decimal point one place to the right multiplies the value of the decimal by 10.

Each removal of the decimal point one place to the left divides the value of the decimal by 10.

A **terminate decimal** is one that either terminates, or can be made to terminate, without a common fraction.

An **interminate decimal** is one that cannot terminate without a common fraction, expressed or understood.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

472. How many letters will it take to write .008 in words?

473. Find the sum of .08, .005, 2.3, 3.04, and .1.

474. Write the smallest decimal that can be expressed by the figures 0, 5, 1, and 7.

475. Write the smallest decimal that can be expressed by the figures 0, 0, 1, 2, 5, 3, and 9.

476. Find the difference between .05 and .025.

477. Ten times a certain decimal is .3. What is one tenth of the decimal?

478. Express $\frac{1}{2}$ of one-hundredth as a decimal.

479. How many tenths in 50 hundredths?

480. How many thousandths in 2 units?

481. Find the difference between the two smallest decimals that can be expressed by the figures 9, 8, and 2.

WRITTEN DRILL EXERCISES.

DIRECTION.—Change to equivalent decimals.

482. $\frac{2}{5}$.	485. $\frac{3}{5}$.	488. $\frac{25}{32}$.	491. $\frac{2}{3}$.	494. $5\frac{1}{3}$.
483. $\frac{3}{4}$.	486. $\frac{3}{80}$.	489. $2\frac{1}{20}$.	492. $\frac{3}{7}$.	495. $6\frac{1}{11}$.
484. $\frac{5}{8}$.	487. $\frac{1}{16}$.	490. $3\frac{1}{4}$.	493. $\frac{5}{9}$.	496. $7\frac{1}{10}$.

DIRECTION.—Change to equivalent fractions.

497. .25.	500. .05.	503. .128.	506. .016.	509. $.33\frac{1}{3}$.
498. .75.	501. .375.	504. .875.	507. .025.	510. $.16\frac{2}{3}$.
499. .5.	502. .625.	505. .125.	508. .512.	511. $.44\frac{4}{5}$.

DIRECTION.—Find the sum of the numbers in each exercise.

512. .321 ; 4.005 ; 32.062 ; 5.121 ; .005 ; .0006.
 513. 92 ; 2.05 ; .025 ; 3.2 ; .001 ; .0051 ; 3.215.
 514. 3.5 ; 21.06 ; 191.04 ; 312.005 ; .05 ; .006 ; 9.
 515. $2\frac{1}{2}$; 2.5 ; $21.0\frac{1}{2}$; 5.05 ; 6.06 ; 3.05 ; $3\frac{1}{5}$; .9.
 516. .005 ; 32.00005 ; 2.2 ; 30.03 ; 3000.1 ; .25 ; 8.
 517. 625 ; 300 ; .003 ; .625 ; 5.051 ; .5105 ; .256.
 518. 5.215 ; .00505 ; 3.3 ; 60.06 ; 311.01 ; $2\frac{1}{2}$; $3\frac{1}{4}$; 25.
 519. $.25\frac{1}{2}$; $.35\frac{1}{4}$; $.0\frac{1}{5}$; $.00\frac{1}{2}$; $.00\frac{1}{8}$; $\frac{1}{4}$; .025 ; 100.
 520. 31.0005 ; 29800.0026 ; 31.012 ; 215.0152 ; 2.2.
 521. 3121.9 ; .99 ; .09 ; 99 ; 9.9 ; 200.009 ; .005 ; 21.

DIRECTION.—Find the difference between the numbers in each exercise.

522. 32.05 ; 9.005. 526. 1.1 ; .11. 530. $3.06\frac{1}{3}$; 2.002.
 523. $2.03\frac{1}{2}$; $2.003\frac{1}{2}$. 527. 11 ; .0011. 531. $2.11\frac{1}{4}$; $1.00\frac{1}{2}$.
 524. 9.25 ; .925. 528. $2\frac{1}{2}$; .05. 532. $42.0\frac{2}{3}$; $3.62\frac{2}{3}$.
 525. $.003\frac{1}{4}$; $30.0\frac{1}{4}$. 529. $5\frac{1}{2}$; $.05\frac{1}{2}$. 533. $3.01\frac{1}{8}$; $.001\frac{1}{8}$.

DIRECTION.—Find the product of the numbers in each exercise.

534. $2.05 \times \frac{1}{2}$. 539. 3.21×2.31 . 544. $21\frac{1}{2} \times 21\frac{1}{2}$.
 535. $3.004 \times \frac{1}{4}$. 540. 9.99×90.9 . 545. 9.021×100 .
 536. $42.01 \times .01$. 541. $2.06 \times .00\frac{1}{2}$. 546. 21.39×1000 .
 537. $2.5 \times .003$. 542. $4.05 \times .03$. 547. $.66\frac{2}{3} \times .05$.
 538. $32.1 \times .05$. 543. $6.02 \times 33\frac{1}{3}$. 548. $39.09 \times .06\frac{1}{4}$.

NOTE.—Divide as in ordinary numbers, and point off from the right of the quotient as many decimal places as the number in the dividend exceeds the number in the divisor.

549. $2.05 \div 2$. 554. $36.\dot{9} \div 9.6$. 559. $.0062 \div .33\frac{1}{3}$.
 550. $30.5 \div 3$. 555. $9.04 \div 99.4$. 560. $.0051 \div .16\frac{1}{2}$.
 551. $21.6 \div .3$. 556. $30.12 \div 6.21$. 561. $.42 \div 2.12$.
 552. $3.05 \div .2$. 557. $4.21 \div 5.12$. 562. $9984.01 \div 2.1$.
 553. $90.8 \div .01$. 558. $.005 \div .006$. 563. $.1 \div .01$.

564. From the sum of $22.52\frac{1}{8}$ and $3.000\frac{1}{4}$ take $10.059\frac{1}{5}$.

565. To the difference between 5 and .5 add .05.

566. $\frac{1}{2} - .05 + \frac{1}{4} + .5 - .025 + \frac{3}{4} - \frac{1}{8} + 2.03$.

567. $12\frac{1}{2} - 2.02 + \frac{3}{4} - .001 + 2.1 - .03 + \frac{2}{5} - .00\frac{1}{2}$.

568. Multiply .006 by .06 and divide the product by 2.

569. How many letters will it take to write 2.005 in words?

570. One hundred times a certain decimal is 2.003. What is one-twentieth of the decimal?

571. Find the product of the two smallest decimals that can be expressed by the figures 0, 0, 9, and 3.

572. The sum of two numbers is 20.02; one of them is 1000 times the other. What are the numbers?

573. The product of two numbers multiplied by $\frac{1}{2}$ is .0005; one of the numbers is .05. What is the other?

IV. BUSINESS EXERCISES.

MIXED NUMBERS.

Illustrative Exercise.

Find the cost of $234\frac{1}{2}$ pounds of cheese at $9\frac{5}{8}$ cents.

$$\begin{array}{r} 234\frac{1}{2} \\ 9\frac{5}{8} \\ \hline 117\frac{1}{4} \\ 29\frac{5}{16} \\ \hline 2110\frac{1}{2} \\ \hline \$22.57\frac{1}{8} \end{array}$$

ANALYSIS.— $\frac{5}{8} = \frac{1}{2} + \frac{1}{8}$. Multiply $234\frac{1}{2}$ by $\frac{1}{2}$ by dividing by 2. Multiply $234\frac{1}{2}$ by $\frac{1}{8}$ by dividing by 8. Multiply $234\frac{1}{2}$ by 9 and add the results.

NOTE.—In multiplying small numbers it will be found easier to reduce to fractions and multiply in the ordinary way. The above method is well adapted to commercial operations, in which the fractions are usually small.

574. $3\frac{1}{2} \times 2\frac{1}{4}$. 578. $10\frac{1}{3} \times 4\frac{1}{5}$. 582. $10\frac{1}{4} \times 2\frac{1}{2}$. 586. $25\frac{1}{2} \times 2\frac{1}{2}$.
 575. $4\frac{1}{4} \times 3\frac{1}{3}$. 579. $3\frac{1}{2} \times 5\frac{1}{4}$. 583. $18\frac{1}{8} \times 3\frac{1}{3}$. 587. $32\frac{1}{2} \times 3\frac{1}{5}$.
 576. $2\frac{1}{9} \times 2\frac{1}{5}$. 580. $12\frac{1}{3} \times 2\frac{1}{9}$. 584. $15\frac{1}{5} \times 2\frac{1}{4}$. 588. $45\frac{1}{4} \times 1\frac{1}{2}$.
 577. $3\frac{1}{8} \times 8\frac{1}{3}$. 581. $18\frac{1}{4} \times 10\frac{1}{2}$. 585. $23\frac{1}{2} \times 2\frac{1}{2}$. 589. $32\frac{1}{7} \times 3\frac{1}{3}$.

NOTE.—In the answers to the following business transactions the fraction, if less than $\frac{1}{2}$, is omitted, and if $\frac{1}{2}$ or more, $\frac{1}{2}$ is added.

590. Find the cost of $203\frac{1}{2}$ pounds of tea at $37\frac{1}{2}$ cents a pound.
 591. What is the cost of $25\frac{3}{4}$ pounds of coffee at $18\frac{1}{8}$ cents a pound?
 592. Find the cost of $3021\frac{3}{4}$ pounds of ham at $12\frac{1}{2}$ cents a pound.
 593. What is the cost of $2031\frac{1}{2}$ bushels of wheat at $\$1.12\frac{1}{4}$ a bushel?
 594. Find the cost of 1021 bushels of oats at $62\frac{1}{2}$ cents a bushel.
 595. Find the cost of 8312 yards of muslin at $37\frac{1}{2}$ cents a yard.

596. Find the cost of $32\frac{1}{2}$ pounds of butter at $16\frac{1}{2}$ cents a pound.

597. Find the value of 2993 pounds of sugar at $7\frac{3}{4}$ cents a pound.

598. What is the value of $2132\frac{1}{4}$ yards of print at $6\frac{1}{2}$ cents a yard?

599. Find the cost of $32\frac{3}{4}$ dozen eggs at $12\frac{1}{2}$ cents a dozen.

600. Find the cost of $421\frac{1}{8}$ bushels of oats at $27\frac{1}{2}$ cents a bushel.

601. What is the value of $62\frac{1}{4}$ yards of sheeting at $8\frac{3}{4}$ cents a yard?

DECIMALS.

NOTE.—To divide a decimal by 10, 100, 1000, etc., remove the decimal point as many places to the left as there are ciphers in the divisor, prefixing ciphers to the dividend if necessary.

602. Find the cost of 3235 pounds of coal at \$5.25 a ton.

NOTE.—If the third decimal figure in the product be less than 5, omit it and all following it; if 5 or more, add one to the second decimal figure and omit all following. A ton equals 2000 pounds.

603. Find the cost of 4325 pounds of coal at \$5.75 a ton.

604. Find the cost of 6984 pounds of coal at \$4.85 a ton.

605. Find the cost of 21,535 pounds of coal at \$5.25 a ton.

606. Find the cost of 6284 feet of lumber at \$12.35 a M.

607. Find the cost of 936 feet of lumber at \$2.37 $\frac{1}{2}$ a hundred.

608. Find the cost of 936 feet of lumber at \$24.25 a M.

609. Find the cost of 8463 feet of lumber at \$27.35 per M.

610. Find the cost of 3684 pounds of pork at \$9.24 a hundred.

611. Find the cost of 945 pounds of pork at \$8.32 a hundred.

612. Find the cost of $837\frac{1}{2}$ pounds of beef at \$6.48 a hundred.

613. Find the cost of 428 pounds of bran at 75c. a hundred.

614. Find the cost of 8462 pounds of hay at \$22.50 a ton.
 615. Find the cost of 6521 pounds of hay at \$43.25 a ton.
 616. Find the cost of 2198 pounds of straw at \$9.55 a ton.
 617. Find the cost of 6225 bricks at \$8.25 a thousand.
 618. Find the cost of 4750 envelopes at \$1.37 per thousand.
 619. Find the cost of 3250 lath at $18\frac{1}{2}$ c. a hundred.
 620. Find the cost of constructing 5984 feet of sidewalk at \$137.50 per thousand feet.

SHORT METHODS.

Illustrative Exercises.

1. Find the sum of $\frac{1}{3}$ and $\frac{1}{4}$.

$$\left. \begin{array}{l} 3 + 4 = 7 \\ 3 \times 4 = 12 \end{array} \right\} = \frac{7}{12}$$

Here there are two fractions, and the numerator is 1 in each case. To find their sum, add 3 and 4 for the numerator and multiply them for the denominator.

2. Find the difference between $\frac{1}{3}$ and $\frac{1}{4}$.

$$\left. \begin{array}{l} 4 - 3 = 1 \\ 3 \times 4 = 12 \end{array} \right\} = \frac{1}{12}$$

Here there are two fractions, and the numerator is 1 in each case. To find their difference, subtract 3 from 4 for the numerator and multiply them for the denominator.

3. Find the sum of $\frac{2}{3}$ and $\frac{2}{5}$.

$$\left. \begin{array}{l} 2 \times 5 = 10 \\ 3 \times 3 = 9 \end{array} \right\} = 19 = \text{numerator.}$$

$$3 \times 5 = 15 = \text{denominator.}$$

$$1\frac{2}{6} = 1\frac{4}{15}.$$

Here the numerators are greater than 1. To find the sum of the fractions, multiply the numerator of the first by the denominator of the second, and the denominator of the first by the numerator of the second, and add the products for the numerator of the answer. Multiply the denominators for the denominator of the answer.

4. Find the difference between $\frac{2}{3}$ and $\frac{2}{5}$.

$$\left. \begin{array}{l} 2 \times 5 = 10 \\ 3 \times 3 = 9 \end{array} \right\} = 1 = \text{numerator.}$$

$$3 \times 5 = 15 = \text{denominator.}$$

$$1\frac{2}{15} = \text{difference.}$$

To find the difference between the fractions, subtract after multiplying, instead of adding.

NOTE.—Do not use pen or pencil.

621. $\frac{1}{2} + \frac{1}{3}$.	633. $\frac{1}{2} - \frac{1}{3}$.	645. $\frac{1}{2} + \frac{2}{3}$.	657. $\frac{2}{3} - \frac{1}{2}$.
622. $\frac{1}{2} + \frac{1}{4}$.	634. $\frac{1}{2} - \frac{1}{4}$.	646. $\frac{1}{2} + \frac{2}{5}$.	658. $\frac{2}{3} - \frac{1}{4}$.
623. $\frac{1}{2} + \frac{1}{5}$.	635. $\frac{1}{2} - \frac{1}{5}$.	647. $\frac{1}{2} + \frac{3}{5}$.	659. $\frac{3}{4} - \frac{2}{3}$.
624. $\frac{1}{2} + \frac{1}{6}$.	636. $\frac{1}{3} - \frac{1}{5}$.	648. $\frac{1}{3} + \frac{2}{5}$.	660. $\frac{2}{5} - \frac{1}{3}$.
625. $\frac{1}{3} + \frac{1}{4}$.	637. $\frac{1}{3} - \frac{1}{7}$.	649. $\frac{1}{3} + \frac{4}{5}$.	661. $\frac{3}{5} - \frac{1}{2}$.
626. $\frac{1}{2} + \frac{1}{7}$.	638. $\frac{1}{4} - \frac{1}{7}$.	650. $\frac{1}{4} + \frac{3}{5}$.	662. $\frac{4}{5} - \frac{2}{3}$.
627. $\frac{1}{2} + \frac{1}{9}$.	639. $\frac{1}{4} - \frac{1}{9}$.	651. $\frac{1}{4} + \frac{4}{5}$.	663. $\frac{3}{4} - \frac{1}{5}$.
628. $\frac{1}{3} + \frac{1}{7}$.	640. $\frac{1}{5} - \frac{1}{6}$.	652. $\frac{1}{5} + \frac{3}{4}$.	664. $\frac{3}{7} - \frac{1}{6}$.
629. $\frac{1}{4} + \frac{1}{5}$.	641. $\frac{1}{2} - \frac{1}{6}$.	653. $\frac{2}{3} + \frac{3}{4}$.	665. $\frac{2}{3} - \frac{3}{7}$.
630. $\frac{1}{3} + \frac{1}{5}$.	642. $\frac{1}{2} - \frac{1}{9}$.	654. $\frac{3}{5} + \frac{3}{4}$.	666. $\frac{4}{7} - \frac{1}{2}$.
631. $\frac{1}{4} + \frac{1}{7}$.	643. $\frac{1}{3} - \frac{1}{9}$.	655. $\frac{3}{5} + \frac{2}{3}$.	667. $\frac{5}{7} - \frac{1}{4}$.
632. $\frac{1}{3} + \frac{1}{6}$.	644. $\frac{1}{3} - \frac{1}{4}$.	656. $\frac{3}{7} + \frac{2}{5}$.	668. $\frac{5}{9} - \frac{1}{3}$.

V. REVIEW.

EXERCISES IN ANALYSIS.

669. If 5 pounds of tea cost \$3.25, what will 9 pounds cost?

5 pounds cost \$3.25,

1 pound costs $\$3.25 \div 5 = 65$ cents,

9 pounds cost $65 \text{ cents} \times 9 = \5.85 .

670. If 9 pounds of butter cost \$1.98, what will 21 pounds cost?

671. If 27 yards of cloth cost \$12.42, what will 113 yards cost?

672. If 12 men can do a piece of work in 42 days, in how many days can 28 men do it?

12 men can do the work in 42 days,

1 man can do the work in $42 \times 12 = 504$ days,

28 men can do the work in $504 \text{ days} \div 28 = 18$ days.

673. If 16 men can build a house in 20 days, how long will it take 40 men to build it ?

674. If 7 tons of coal can be bought for \$42, how many tons can be bought for \$72 ?

675. If it require 250 bushels of wheat to make 50 barrels of flour, how many bushels will be required to make 19 barrels ?

676. If 26 acres of land cost \$2236, what will 127 acres cost at the same rate ?

677. In what time will a boy, at $37\frac{1}{2}$ cents a day, earn as much as a man earns in 75 days, at \$2.27 a day ?

678. If $\frac{3}{10}$ of a farm be worth \$963, what is the value of $\frac{2}{3}$ of the farm ?

679. If $\frac{9}{10}$ of a bin of coal be worth \$63, what is $\frac{3}{7}$ of it worth ?

680. If $\frac{5}{8}$ of a pound of tea cost 50c., what will $16\frac{3}{4}$ pounds cost ?

681. A drain is dug by 45 men in 95 days ; how many men would have been required to dig it in 25 days ?

682. If $\frac{5}{8}$ of a patent-right be worth \$1200, what is the value of the whole patent-right ?

683. A firm had $\frac{1}{4}$ of its capital invested in goods, $\frac{2}{3}$ of the remainder in land, and the remainder, \$1224, in cash. What was the capital of the firm ?

684. If the 4-pound loaf cost 9 cents when flour is \$5.50 a barrel, find its cost when flour is \$7 a barrel.

685. If 24 pounds of rice are worth as much as 18 pounds of sugar, how many pounds of rice are worth as much as 217 pounds of sugar ?

686. If 12 men earn \$72 in one week, how much will 18 men earn, at the same rate, in the same time ?

687. If $2\frac{3}{4}$ yards of broadcloth be worth \$23.10, what is the value of $16\frac{7}{8}$ yards at the same rate ?

688. If $\frac{3}{4}$ of an acre of land cost \$60, what will $87\frac{1}{2}$ acres cost at the same rate ?

MISCELLANEOUS EXERCISES.

689. What are the prime factors of 25920 ?

690. Find the H. C. F. of 235 and 685.

691. Find the L. C. M. of 3, 25, 60, and 100.

692. Find the greatest number that will divide 392 and 257, leaving as remainders 7 and 12.

693. What is the H. C. F. of 182, 364, and 455 ?

694. Four cheeses, weighing respectively $32\frac{1}{2}$ pounds, $41\frac{1}{4}$ pounds, $37\frac{3}{4}$ pounds, and 51 pounds, were sold at 22 cents a pound. How much was received for them ?

695. Five-sevenths of $\frac{1}{2}$ of a number is 75. What is the number ?

696. Write down all the common multiples of 720 and 1008 that are less than 30000.

697. Divide .012261 by 2.01.

698. A can cut $1\frac{1}{4}$ cords of wood in $\frac{5}{8}$ of a day ; B can cut as much in $\frac{1}{3}$ of a day as A can cut in $\frac{1}{2}$ of a day. How long will it take them to cut 30 cords working together ?

699. The H. C. F. of two numbers is 17, and their L. C. M. is 3876. One number is 204. Find the other.

700. I spent $\frac{1}{5}$ of my money and \$6 more, then $\frac{1}{3}$ of the remainder and \$5 more, then $\frac{2}{3}$ of what was left and \$15 more. I then had \$18. How much had I at first ?

701. A farmer sold 24 dozen eggs at $22\frac{1}{2}$ cents a dozen, and 12 pounds of butter at $27\frac{1}{2}$ cents a pound. He was paid in tea at 87 cents a pound. How many pounds of tea should he receive ?

702. Find three numbers less than 125 which are multiples of both 12 and 18.

703. A gentleman gave away $\frac{1}{5}$ of the books in his library, lent $\frac{1}{4}$ of the remainder, and sold $\frac{1}{3}$ of what was left. He found that he had 400 books remaining. How many had he at first ?

704. A man engaged to work a year for \$600 and a suit of clothes. At the end of 8 months a just settlement was made by giving him \$390 and the suit of clothes. What was the value of the clothes?

705. There are on a lighthouse three revolving lights. One revolves in 260 seconds, another in 195 seconds, and the third in 390 seconds. They are all bright at 11 p.m. When will they next be so?

706. A train leaves a certain station at 9.30 a.m., and goes $27\frac{1}{3}$ miles an hour. Another train leaves at 10.15 a.m., and goes 41 miles an hour. When will the latter overtake the former?

707. A boy can dig 25 bushels of potatoes in a day, and he can pick 50 bushels in a day. How many bushels can he dig and pick in 5 days?

708. Two-thirds of a number of persons received 15 cents each, and $\frac{1}{3}$ received 9 cents each. They all received \$4.68. How many persons were there?

709. A man and his wife use a bag of flour in 16 days. When the man is away a bag of flour lasts his wife 48 days. How long would it last the man if alone?

710. Divide $125\frac{1}{2}$ acres of land among A, B, and C, giving C $7\frac{1}{4}$ acres more than B, and B $12\frac{3}{4}$ acres more than A.

711. A can do a piece of work in 5 days; B can do the same in 7 days. How long will it take them to do the work jointly?

712. A sold to B a watch for $\frac{1}{5}$ more than it cost him. B sold it to C for \$36, which was $\frac{1}{4}$ less than it cost him. What did A pay for it?

713. The difference between $\frac{1}{2}$ and $\frac{1}{3}$ of a number is 6 less than $\frac{1}{5}$ of the number. Find the number.

714. What must be the divisor and quotient when the dividend is 4352, and the remainder, 17, is the H. C. F. of the divisor and quotient?

+ 715. Find the least number of soldiers that can be divided into companies of 16, 30, 48, 56, or 72?

716. A fine of \$7 had to be raised among a number of boys. One-fourth of them paid 5 cents each; one-fourth paid 9 cents each; one-fourth paid 10 cents each; and the others 11 cents each. How many boys were there?

717. Find the least number which, when divided by 3, 4, 6, or 9, gives 2 as a remainder in each case.

718. Find the greatest number that will divide 2293, 4245, and 5348, leaving 18, 20, and 23 respectively as remainders.

x 719. If a turkey weighing $9\frac{1}{2}$ pounds costs \$1.33, what should one cost that weighs $14\frac{1}{4}$ pounds?

720. There is a number that will divide every one of the numbers 637, 504, 756, and 1001. What is it?

721. If $\frac{1}{6}$ of the time since midnight is equal to $\frac{1}{2}$ of the time since noon, what time is it?

+ 722. What number is that to which if $\frac{3}{5}$ of itself plus 42 be added, the result will be three times the number?

723. The marbles in a box can be made into groups of 17 and none remain, but when made into groups of 16, 18, or 24, 9 remain in each case. How many marbles are there?

+ 724. What number taken from the sum of $10\frac{3}{4}$ and $12\frac{1}{2}$ will leave $5\frac{1}{4}$?

725. A piece of cloth when measured by a yard measure which is .6 of an inch too short appears to be $88\frac{1}{2}$ yards long. What is its true length?

726. Find the smallest number which, when divided by any number between 10 and 20, will leave a remainder.

727. Three persons, B, C, and D, bought a city lot for \$10,400, of which B paid \$3200, C \$2400, and D \$4800. What part of the lot belongs to each?

728. By what number must .001 be multiplied to produce $22\frac{1}{2}$?

729. Ten is added to a certain decimal. The *point* is then moved one place to the left and ten is added. The sum is equal to $4\frac{1}{2}$ times the original decimal. Find the original decimal.

730. $\frac{1}{2} - .05 + \frac{1}{4} + .5 - .025 + \frac{3}{4} - \frac{1}{8} + 2.03 - .01.$

731. The sum of two numbers is 1357. Their difference is $\frac{1}{11}$ of the smaller number. What are the numbers?

732. The sum of two numbers is 4816. Their difference is $\frac{2}{3}$ of the larger number. What are the numbers?

733. Find the sum of all the *proper* fractions that can be formed having only one figure in the numerator and one in the denominator.

NOTE.—The denominator of a proper fraction is greater than the numerator.

734. Divide \$28,217 between two men, giving one $\frac{3}{4}$ of what the other receives.

735. A, B, and C have 540 acres of land. One-third of A's share is equal to $\frac{1}{2}$ of B's, and $\frac{3}{4}$ of B's share is equal to $\frac{6}{7}$ of C's. How many acres has each?

736. If $\frac{1}{3}$ of the time past midnight is equal to $\frac{1}{3}$ of the time until noon, what time is it?

737. Divide \$490 between two men, giving one \$3 as often as the other gets \$4.

738. The sum of two numbers is 3150, and one bears the same relation to $\frac{1}{2}$ as the other does to $\frac{3}{4}$. Find the numbers.

739. Divide 279 acres among A, B, and C, so that B may get twice as much as A, and C three times as much as B.

740. Three men hired a pasture for \$42. The first put in 3 horses, the second 7 horses, and the third 11 horses. How much should each pay?

741. An estate dealer bought a house and lot for \$6420. He spent \$342 in repairs. He then sold it for \$2130 in cash, and a boat valued at \$5900. The boat was burned shortly after the sale. How much did he lose?

742. Two persons join in purchasing some property, one paying \$1250 and the other \$1000. If the property rise in value to \$3750, what will be the value of each one's share?

743. Bell metal contains 78 parts copper and 22 parts tin. What weight of each of these metals will there be in a bell weighing 490 pounds?

744. An army of 12,000 men has provisions for 24 days. How long will these provisions last if the army is reinforced by 9000 men?

745. A, B, and C together have \$645. C has twice as much money as B, and if \$12 be deducted from A's money it will be $\frac{1}{3}$ of B's. How much has each?

746. Divide \$375 among 2 men, 3 women, and 4 boys, so that as often as each boy gets \$2, each woman may get \$3, and each man \$4.

747. A farmer bought three farms of 200 acres each at \$5.25 an acre. He built three barns, one on each, at a cost of \$735 a farm, and 920 rods of fence at \$2.50 a rod. He spent \$125 in improving the houses. He then sold the farms at \$11.25 an acre. Did he gain or lose, and how much?

748. A man walked from A to B at the rate of $3\frac{1}{2}$ miles an hour, remained there an hour and a half, rode back at the rate of 8 miles an hour, reaching A 14 hours after he started. How far is it from A to B?

749. Bought 60 geese and turkeys for \$53, paying 75 cents each for the geese. How many turkeys did I buy, and at what price?

750. A drover bought 100 sheep and calves for \$387, paying \$4.50 each for the sheep. Had the number of sheep and calves been interchanged they would have cost \$413. How many were there of each?

THIRD DEPARTMENT.

I. MEASURES.

HINTS AND DEFINITIONS.

Avoirdupois weight is used in weighing all articles except precious metals and dry medicines.

One ton equals twenty hundredweight, or 2000 pounds.

One pound equals 16 ounces. One stone equals 14 pounds. A barrel of beef or pork weighs 200 pounds.

Linear measure is used in measuring lengths, breadths, depths, heights, or distances.

One mile is equal to 320 rods, or 1760 yards, or 5280 feet.

One rod is equal to $5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet.

There are 12 inches in a foot, and 3 feet in a yard.

A shoemaker's size is one-third of an inch. A hand is 4 inches. A fathom is 6 feet.

Surveyor's linear measure is used by surveyors and engineers in measuring the boundaries of land, the length of roads, etc.

The unit of measurement is the **chain**, which is 4 rods or 66 feet long.

There are 100 links in a chain, and a mile is equal to 80 chains.

Square measure is used in measuring surfaces, such as land, boards, plastering, etc.

There are 144 square inches in a square foot, and 9 square feet in a square yard.

There are $30\frac{1}{4}$ square yards in a square rod, and 160 square rods in an acre.

Surveyors' square measure is used in measuring land.

There are 10 square chains in an acre, and 640 acres in a square mile.

Liquid measure is used in measuring liquids.

There are 4 gills in a pint, 2 pints in a quart, and 4 quarts in a gallon.

There are $31\frac{1}{2}$ gallons in a barrel.

Dry measure is used in measuring dry articles.

There are 8 quarts in a peck, and 4 pecks in a bushel.

The quart and peck of dry measure have about $\frac{1}{8}$ greater capacity than the quart and peck of liquid measure.

All years divisible by 4, except centennial years, are leap years. All centennial years divisible by 400 are leap years.

There are 12 units in a dozen, and 12 dozen in a gross.

There are 24 sheets of paper in a quire, and 20 quires in a ream.

PRACTICAL EXERCISES.

1. Find the value of 280 pounds of oat meal at 45 cents a stone.

What will a hundredweight of beef cost at $18\frac{1}{2}$ cents a pound?

3. How much should a farmer receive for 3 tubs of butter, each containing 63 pounds, at 22 cents a pound?

4. Find the cost of 427 pounds of rice at 64 cents a stone.

5. What will 18 pounds of baking powder cost at $2\frac{1}{2}$ cents an ounce.

6. If 25 pounds of coal cost 15 cents, what will 2 tons of coal cost?

7. A grocer buys 3 tubs of butter, containing 84 pounds each, for \$37.50, and sells the whole at 18 cents a pound. How much does he gain or lose?

8. A butcher buys a barrel of pork for \$24, and sells the whole at 19 cents a pound. Find his profit.

9. Find the cost of 18 tons of hay at 75 cents a hundredweight.

10. Find the cost of 56 ounces of candy at 18 cents a pound.

11. How much will 924 pounds of feed cost at \$1.50 a hundredweight?

12. A load of hay with the wagon weighs 2348 pounds. The wagon weighs 829 pounds. Find the value of the hay at \$24.50 a ton.

13. A barrel of beef which cost \$18.75 is retailed at $12\frac{1}{2}$ cents a pound. How much is gained?

14. Find the cost of 375 pounds of straw at 25 cents a hundredweight.

15. What will 5680 pounds of bran cost at \$27.50 a ton?

16. Find the cost of 2985 pounds of bran at 54 cents a hundredweight.

NOTE.—Grain, seeds, and similar produce, are usually sold by the bushel. The number of pounds in a bushel differs in different States and Provinces. The exercises given in this book are based upon the following table :—

Barley.....48 lbs.	In California, 50 ; Louisiana, 32 ; Massachusetts, Vermont and Oregon, 46 ; Pennsylvania, 47.
Wheat.....60 lbs.	In Connecticut, 56.
Oats.....32 lbs.	In Canada, 34 ; Connecticut, 28 ; Iowa, 35 ; Maine, Massachusetts, North Carolina and New Jersey, 30 ; Kentucky, 33½.
Corn.....56 lbs.	In Illinois and California, 52 ; New Hampshire, 54 ; New York, 58.
Rye56 lbs.	In California and Illinois, 54.
Peas.....60 lbs.	
Clover Seed.....60 lbs.	In New Jersey, 64.
Timothy Seed...45 lbs.	In Canada, 48 ; New York, 44 ; Wisconsin, 46.

DIRECTION.—In the exercises which follow, the cost or selling price of the grain is to be found. Omit fractions of a cent in the answer, when less than $\frac{1}{2}$. When $\frac{1}{2}$ or more, add 1 cent.

17. Wheat—1240 pounds at 90 cents a bushel.

18. Wheat—2150 pounds at 85 cents a bushel.

19. Wheat—3265 pounds at \$1.20 a bushel.

20. Wheat—6428 pounds at \$1.12 a bushel.

21. Wheat—3529 pounds at \$1.15½ a bushel.

22. Wheat—5965 pounds at \$1.02 a bushel.

23. Barley—3246 pounds at 88 cents a bushel.

24. Barley—6487 pounds at 92 cents a bushel.

25. Barley—4005 pounds at 39 cents a bushel.

26. Corn—5684 pounds at 58 cents a bushel.

27. Corn—2469 pounds at 88 cents a bushel.

28. Corn—3425 pounds at 72 cents a bushel.

29. Corn—5680 pounds at 99 cents a bushel.

30. Oats—1000 pounds at 36 cents a bushel.

31. Oats—2569 pounds at 56 cents a bushel.
32. Peas—9846 pounds at 64 cents a bushel.
33. Rye—2485 pounds at 98 cents a bushel.
34. Rye—3215 pounds at 92 cents a bushel.
35. Rye—4621 pounds at 75 cents a bushel.
36. Clover Seed—1984 pounds at \$2.90 a bushel.

NOTE.—In a few cities produce is bought and sold by the *cental* of 100 pounds.

37. When wheat is quoted at \$1.20 a bushel, how much is it worth per cental ?

38. When corn is quoted at 90 cents a bushel, how much is it worth per cental ?

39. When barley is quoted at 96 cents a bushel, how much is it worth per cental ?

40. When wheat is quoted at \$1.37½ per cental, what is it worth per bushel ?

41. When corn is quoted at \$1.10 per cental, what is it worth per bushel ?

42. A produce dealer buys 3360 pounds of wheat in Massachusetts at \$1.15 per bushel, and sells it in Connecticut at the same price. How much does he gain ?

43. A produce dealer buys 4480 pounds of oats in Iowa at 63 cents per bushel, and sells the same in Illinois at 60 cents. Does he gain or lose, and how much ?

44. A produce dealer buys 5600 pounds of oats in Kentucky at 54 cents, and sells the same in North Carolina at 55 cents. How much does he gain ?

45. A dealer in corn buys 22,736 pounds in New York State at 72 cents, and sells the same in Ohio at 75 cents. How much does he gain ?

46. A dealer in barley buys 27,830 pounds in California at 93 cents, and sells the same in Oregon at \$1. How much does he gain ?

47. Find the total weight, in pounds, of
Three tons of hay and two tons of straw.
Twenty-four ounces of iron and 32 ounces of lead.
Four stone of oat meal and 3 stone of rice.
A barrel of beef and a barrel of flour.
Three bushels of wheat and 4 bushels of barley.
A cental of oats and a bushel of corn.
48. How many inches are there in $3\frac{1}{2}$ rods ?
49. How many inches are there in a chain ?
50. A horse is $15\frac{1}{2}$ hands high ; how many inches high is he ?
51. A lake is $112\frac{1}{3}$ fathoms deep ; how many feet deep is it ?
52. How many yards in 24 chains ?
53. How many links are there in 110 yards ?
54. How many inches are there in three miles ?
55. Find the cost of 20 miles of telephone wire at 35 cents a pound, supposing one pound stretches 80 feet.
56. Find the cost of 4 miles of barbed wire at $\frac{3}{4}$ cents per foot.
57. What will it cost to survey 25 miles of road at 25 cents a chain ?
58. What is the cost of a cable 921 feet long at 95 cents a yard ?
59. Find the total length, in feet, of
180 rods, 22 yards, 3 miles.
55 inches, 16 hands, $8\frac{1}{2}$ fathoms.
12 chains, 3 sizes, 150 links.
60. How many square inches are there in a square yard ?
61. How many square feet are there in a square chain ?
62. How many square rods are there in 250 square chains ?
63. Find the cost of 15 square yards of canvas at 12 cents a square foot.

64. Find the cost of $221\frac{1}{2}$ yards of cloth at \$1.32 a yard.
65. Find the cost of 18 square feet of gold leaf at $2\frac{1}{2}$ cents a square inch.
66. Find the cost of a square mile of farm land at \$4.25 an acre.
67. What will 3200 square rods of land cost at \$1.25 per square chain?
68. How many pints of oil in a vessel containing 15 gallons?
69. A fruit dealer bought 5 bushels of cherries at \$2.50 a bushel, and sold them at 15 cents a quart. Did he gain or lose, and how much?
70. How many quarts of berries are there in 12 pails, if each contain $\frac{3}{4}$ of a peck?
71. What is the value of 3426 bushels of potatoes at 42 cents a peck?
72. A grocer bought a barrel ($31\frac{1}{2}$ gallons) of syrup for \$7.50. He sold half of it at 18 cents a quart, and the remainder at 22 cents a quart. How much did he gain?
73. How many weeks are there in the years 1884, 1885, 1886, 1887 and 1888?
74. How many hours are there in 3 weeks?
75. How many minutes from 7.30 p.m., Monday, until 3.15 a.m., Tuesday.
76. How many minutes from 2.35 p.m., Saturday, until 8.43 a.m., Monday?
77. How many hours from 1.22 a.m., February 24, 1885, until 9.22 p.m., March 3, 1886?
78. How many leap years between 1775 and 1905?
79. A boy bought a gross of penholders for 80 cents, and sold them at 3 cents each. How much did he make?
80. How many sheets of paper in 3 reams?

81. A stationer bought 4 reams of foolscap at \$2.75 a ream, and sold half of it at 25 cents a quire and the remainder at the rate of 4 sheets for 5 cents. Find his entire profit.

82. Find the cost of 25 gross of writing-pads at 75 cents a dozen.

II. CURRENCY.

HINTS AND DEFINITIONS.

The term **legal tender** is applied to money which may be legally offered in the payment of debts.

Sterling money is the name applied to the legal currency of Great Britain.

The unit of this currency is the pound (£) or sovereign, the value of which in dollars and cents is \$4.86 $\frac{2}{3}$.

There are 12 pence (*d.*) in a shilling (*s.*) and 20 shillings in a pound.

A **crown** is one-quarter of a pound, and a **guinea** is equal to 21 shillings, or \$5.11 in American currency.

The **franc** of France, Belgium, and Switzerland is equal to about 19 $\frac{1}{2}$ cents.

The **crown** of Norway, Sweden, and Denmark is equal to about 26 $\frac{1}{2}$ cents.

The **mark** of Germany is equal to about 23 $\frac{1}{2}$ cents.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

83. How many five-cent pieces in \$12?

84. How many pence are there in £3?

85. Write the value of an English crown in cents.

86. Write the value of two guineas in dollars and cents.

87. What is the difference in value between two guineas and one eagle?

88. What is the difference in value between a pound sterling and five dollars?

89. What is the difference in value between four *marks* and one dollar?

90. What is the difference in value between a *franc* and a quarter of a dollar?

91. What is the difference in value between an English and a Danish crown?

92. A boy has three sovereigns, four half-dollars, and five *marks*. His money is equal to how many cents?

BUSINESS EXERCISES.

NOTE.—The following method of reducing shillings and pence to the decimal of a pound is sufficiently accurate for most business purposes:—

Write one-half of the greatest even number of shillings as tenths, and if there be an odd shilling write five hundredths; reduce the pence to farthings, and write their number as thousandths. If the number of farthings is between 12 and 36, add 1 to the thousandths; if between 36 and 48, add 2 to the thousandths.

Illustrative Exercises.

1. Reduce £3 14s. 6d. to the decimal of a pound.

Put down the £3; then divide the 14 by 2, and put down 7; then multiply 6 by 4 and add 1. The result will stand thus: £3.725.

2. Reduce £4 15s. 10d. to the decimal of a pound.

In this exercise one-half of 15 is $7\frac{1}{2}$, an uneven number. We put it down in the decimal form: .75. Four times 10 are 40; add 2 and we have 42, or .042, which, added to .75, gives .792. The work will stand thus:

$$£4\ 15s.\ 10d. = £4.7\frac{1}{2}2 = £4.792.$$

DIRECTION.—The shillings and pence in the following exercises are to be reduced to the decimal of a pound by the method explained above.

93. £2 3s. 6d.	100. £2 1s. 11d.	107. £12 11s. 9d.
94. £4 6s. 5d.	101. £3 2s. 10d.	108. £22 12s. 8d.
95. £8 7s. 4d.	102. £4 3s. 9d.	109. £25 13s. 7d.
96. £9 3s. 5d.	103. £5 4s. 8d.	110. £24 14s. 6d.
97. £4 7s. 8d.	104. £6 5s. 7d.	111. £23 15s. 7d.
98. £2 8s. 7d.	105. £7 6s. 10d.	112. £22 16s. 5d.
99. £3 3s. 9d.	106. £8 7s. 11d.	113. £31 17s. 8d.

NOTE.—When money is at par value, and for nearly all practical purposes, the following is the best and shortest method of reducing English money to dollars and cents :—

\$4.00

.80 = $\frac{1}{5}$ of 400.

$6\frac{2}{3} = \frac{1}{1\frac{1}{2}}$ of 400.

\$4.86 $\frac{2}{3}$

The pound sterling is equal to \$4.86 $\frac{2}{3}$. Now, 80 is $\frac{1}{5}$ of 400, and $6\frac{2}{3}$ is $\frac{1}{1\frac{1}{2}}$ of 80. Then, to multiply by 486 $\frac{2}{3}$, multiply by 400, divide the product by 5 and place the quotient under ; then divide this quotient by 12, and place the second quotient under the first. Add, and the sum will be the same as though the number were multiplied by 486 $\frac{2}{3}$ in the ordinary way.

Illustrative Exercise.

Find the value of £3.725 in dollars and cents.

£3.725 \times 4.86 $\frac{2}{3}$

£3.725

4

5	14.900
12	2.980
	.248

\$18.128

Multiply by 4 for the dollars. Then divide this product by 5, which is equivalent to multiplying £3.725 by .80 ; and dividing 2.98 by 12 is equivalent to multiplying £3.725 by .06 $\frac{2}{3}$, for $\frac{1}{1\frac{1}{2}}$ of $\frac{1}{5}$ of 400 is $6\frac{2}{3}$.

DIRECTION.—Find the value of the following sums in dollars and cents :—

114. £2.643. 119. £2.213. 124. £0.432. 129. £12.219.

115. £3.425. 120. £4.421. 125. £0.569. 130. £16.190.

116. £4.216. 121. £5.563. 126. £0.982. 131. £18.263.

117. £5.319. 122. £6.428. 127. £0.846. 132. £21.508.

118. £8.214. 123. £9.365. 128. £0.912. 133. £13.009.

134. Find the value in dollars and cents of a P. O. money order for £2 6s. 10d.

135. Find the value in dollars and cents of a P. O. money order for £12 13s. 4d.

136. What is the value in American currency of 800 crowns of Denmark ?

137. If 5 shillings be worth \$1.22, how much should one receive for an English P. O. money order for £24 11s. 6d. ?

138. What is the value in American currency of 330 francs of France?

139. What is the difference in value (dollars and cents) between 1200 crowns of Great Britain and 1200 crowns of Sweden?

140. A New York manufacturer owes an advertising bill of £1 11s. 6d. in London, England. How much will a foreign money order for this sum cost him, supposing the charges to be 50 cents?

141. Find the value in Swiss francs of \$5.80.

142. Find the total value in American currency of the following :—

Three pounds sterling.
Twenty-five shillings.
One hundred and eight pence.
Twenty-three guineas.
One hundred marks.

III. WAGES.

PRACTICAL EXERCISES.

NOTE.—Wages are usually calculated on a scale of ten hours' labor per day. Six days are considered one week.

143. A man earns \$2.25 a day. How much will he earn in a month of August the first day of which is Wednesday?

144. A man earns \$3.35 a day. How much will he earn in a month of March the first day of which is Friday?

145. A man working $11\frac{1}{2}$ hours a day at 30 cents an hour will earn how much in a week?

146. How much will a boy earn in a week who earns 18 cents an hour and works $12\frac{1}{2}$ hours a day?

147. Thirty-five cents an hour is equivalent to how much a month (four weeks)?

148. A farmer hired a man on March 15, at \$24 a month. The man left on November 31 following. How much did he earn?

149. A mechanic's wages are \$2.75 a day. On a certain day he began work at 9.30 a.m. and left off at 4 p.m. How much did he earn on that day if he took an hour at noon?

150. A man earning \$1.75 a day works on a certain day from 1 p.m. to 4.30 p.m. How much does he earn on that day?

151. A man earning \$2 a day lost $13\frac{1}{2}$ hours in one week. What were his wages for that week?

152. At \$2.20 a day, how much should a machinist receive for $142\frac{1}{2}$ hours' labor?

153. A foreman receives \$2.90 a day, and 50 cents an hour for overtime. During a certain week he works from 6.30 a.m. until 10.30 p.m. (less 2 hours for meals) each day. What are his wages for that week?

154. A foreman receives \$3 a day, and 60 cents an hour for overtime. He is charged 20 cents for each hour he is absent. His time for a week is as follows: $12\frac{1}{2}$ hrs., 8 hrs., $8\frac{1}{2}$ hrs., 13 hrs., $10\frac{1}{2}$ hrs., and 13 hrs. What should his wages be?

155. A carpenter worked a certain number of days and received \$41.25; if he had worked 21 days more he would have received \$67.50. How many days did he work?

156. A boy commenced work on Tuesday, April 7, 1885, at 60 cents a day. He worked (six days each week) until the evening of September 17th, 1885, except during a sickness which lasted from June 27 until July 8 inclusive. Upon August 3 his wages were increased to 75 cents a day. He paid \$1.26 a week for his board and other expenses. The rest of his money he sent to his mother. How much did he send her?

157. Three brothers, A, B, and C, worked together 12 days. Their wages amounted to \$63.60. C received as much per day as A and B together, and B received 15 cents per day more than A. Find A's daily wages.

DIRECTION.—In each exercise which follows find the total wages for the week. The numbers written after the names represent the number of hours that each man worked on a particular day.

158. BUILDER'S TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
John Adair	8½	10	10	10	8	5	\$2.75
Fred Rogers	10	2½	5	10	10	4	\$2.60
Thos. Wells	10	10	8	7½	3½	2	\$2.60
Will Ring	5	10	10	10	2½	5	\$2.20
Amos Pudsey . . .	9	7	10	8	10	3	\$2.50
Jas. Anderson . .	4	10	7	9	4	4	\$2.25

159. CONTRACTOR'S TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
Wm. Eaton	9½	10½	10	10	3	10	\$1.75
Robt. Gilray . . .	8½	10	10	2½	10	10	\$2.00
R. Ball	7	10	6	3	10	9	\$1.60
James Reid	6½	3½	9	8	4	10	\$1.40
Thos. Watt	2½	3	4	5	6	7	\$1.25
Jas. Courtney . .	8	10	10	9	7	4	\$1.75

160. MANUFACTURER'S TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
J. Parker	12	12	12	13½	6	6	\$2.10
R. Fisher	10	10	10	4	5	3	\$2.20
Thos. Brown . . .	2	16	8	6	9	4½	\$2.00
James Welch . . .	5½	6	3	10	10	10	\$2.50
H. Cooper	9	10	10	9½	12	10	\$2.25
T. Wilson	7	9	8¾	10	10	7	\$2.50

161. MILLER'S TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
R. Kelley	10	12	11	10½	13	5	\$1.85
J. Watson	16	12½	7½	8	4	6	\$1.15
M. Brier	10	10	10	3½	6	7	\$1.40
F. King	10½	15	3½	4½	8	8	\$1.25
J. Looce	18	6	12	3½	10	10	\$1.15

DIRECTION.—In the two exercises which follow deduct 10 cents an hour for lost time, and allow 40 cents an hour for overtime.

162. PRINTER'S TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
R. Miln	10	12	4	3½	6	8	\$3.00
J. Smith	8	10	5	4	12½	5	\$2.75
C. Woods.....	7	10	6½	6	13	6	\$2.50
W. Sim	10	0	7½	10	14	4	\$2.50
J. Mortimer	12½	0	10	12	13½	3	\$2.40
E. Caswell.....	5	11	10	10	10	8	\$2.25

163. FOUNDRY TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
R. Hood	10	8	10	14½	10	4	\$2.15
K. Hall	12	9½	10	8½	10	4	\$3.10
R. Bell.....	12	8	10	9	10	5	\$1.75
S. Root	10	8	10	10	10	4	\$2.00
C. Blackhall....	9	10	6	9	10	5	\$2.50

DIRECTION.—In the two exercises which follow consider eight hours' labor a full day.

164. FACTORY TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
J. Seymour.....	7	8	8	7½	6	5	90c.
T. Wyndham....	7	8	8	6	6	5	85c.
S. Marshall.....	7½	8	8½	4	8	4	90c.
E. Thornton	7	8	8	3	8½	5	75c.
R. Maxwell.....	6	8	8	2	9	5	65c.

165. CABINETMAKER'S TIME SHEET.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per day.
F. Allan.....	8	8	8	8	8	8	\$1.15
E. Smith	7	7½	7	7½	7	8	\$1.40
T. Brown.....	6	7	6	6	5	6	\$1.80
K. Faddis	2	8½	9	9	7½	5	\$1.75
J. Coulter.....	8	6	7	5	8	4	\$1.50

IV. BILLS AND ACCOUNTS.

HINTS AND DEFINITIONS.

A **bill** or an **account** is a detailed statement of merchandise sold, or of services rendered.

A person who owes money, goods, or services, is called a **debtor**; and the person to whom the money, goods, or services are due, is called a **creditor**.

A *bill* should state the names of the buyer and seller, the place and time of the transaction, and any special terms agreed upon by the parties.

A *bill* is *receipted* when the words "Received Payment," or "Paid," are written at the bottom, and the creditor, or some one acting for him, affixes his name.

After an *itemized* bill has been rendered and not paid, the creditor does not usually make out a second bill complete, but simply the form of a bill with the words "To Merchandise," "To Labor," or "To Account rendered," and the total amount. This incomplete form is termed a **statement**.

If goods are sold on *credit* after an itemized bill of a previous purchase has been rendered, the new bill will have the words "To old Account," or "To Account rendered," at the top; that is, if nothing has been paid.

Goods are sold *on account*, or *on credit*, when they are not paid for when delivered.

BUSINESS EXERCISES.

166.

Transactions.

Aug. 20, 1885. The One Price Store, Collingwood. Richard Ball buys of C. E. Brown & Co., on account, 26 yds. Silk at \$1.45; 4 yds. Lining at 15c.; 2½ yds. Lining at 20c.; 4 yds. Muslin at 11c.; 2 doz. Buttons at 25c.; 12 yds. Flannel at 38c.; 5 yds. Cotton at 14c.; 2 pair Kid Gloves at \$1.25; 3½ yds. Ribbon at 42c.; 1 Silk Handkerchief, \$1.45; 6½ yds. Embroidery at 36c.

Oct. 15, 1885. Richard Ball buys of C. E. Brown & Co., on account, 15 yds. Black Cloth at \$2.10; 5 yds. Tweed at \$1.85.

Nov. 13, 1885. Richard Ball pays C. E. Brown & Co., on account, cash, \$45.25.

Dec. 15, 1885. Richard Ball pays C. E. Brown & Co., cash, \$48.26 to balance account.

Pupils' Work.

Make out and render an itemized bill, August 31.

Render a statement on September 30.

Make out the account to be rendered October 31.

Credit this last bill with the amount paid November 13.

Render a statement on November 30.

Receipt this last statement in full, December 15.

[ITEMIZED BILL.]

COLLINGWOOD, Aug. 31, 1885.

Mr. Richard Ball,

To C. E. Brown & Co., Dr.

Accounts rendered monthly.

Aug.	20	26 yds. Silk	@ \$1.45	37	70	
		4 yds. Lining	@ .15		60	
		2½ yds. Lining	@ .20		50	
		4 yds. Muslin	@ .11		44	
		2 doz. Buttons	@ .25		50	
		12 yds. Flannel	@ .38	4	56	
		5 yds. Cotton	@ .14		70	
		2 pair Kid Gloves	@ 1.25	2	50	
		3½ yds. Ribbon	@ .42	1	47	
		1 Silk Handkerchief	@	1	45	
		6½ yds. Embroidery	@ .36	2	34	
					52	76

[STATEMENT.]

COLLINGWOOD, Sept. 30, 1885.

Mr. Richard Ball,

To C. E. Brown & Co., Dr.

Accounts rendered monthly.

		To Account rendered Aug. 31. . . .			52	76
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[STATEMENT AND BILL.]

COLLINGWOOD, Oct. 31, 1885.

*Mr. Richard Ball,**To C. E. Brown & Co., Dr.*

Accounts rendered monthly.

		To Account rendered Sept. 30. . .			52	76
Oct.	15	15 yds. Black Cloth . . @ \$2.10	31	50		
		5 yds. Tweed . . . @ 1.85	9	25		
					40	75
		Received cash, \$45.25.			93	51
		C. E. BROWN & Co.				

[STATEMENT.]

COLLINGWOOD, Nov. 30, 1885.

*Mr. Richard Ball,**To C. E. Brown & Co., Dr.*

Accounts rendered monthly.

		To Balance of Account.			48	26
		Received payment in full.				
		C. E. BROWN & Co.,				
		per B. K.				

NOTE.—When a clerk receipts a bill it is customary and necessary to write his initials under the name of the creditor, or to write his own name, and directly underneath his own name that of his employer, preceded by the word *for*; as,

Received cash, \$45.25.

JAMES ALLAN,

for C. E. BROWN & Co.

167.

Transactions.

March 15, 1886. The District Exchange, Jamestown. Robert Walker buys of T. Myers & Co., on account, 22 lbs. Sugar at 11c.; 12 lbs. Butter at 23c.; 18 lbs. Cheese at 19c.; 14½ lbs. Tea at 55c.; 15½ lbs. Dried Apples at 8c.; 7½ lbs. Currants at 8c.; 17 lbs. Biscuits at 13c.

April 2, 1886. Robert Walker pays his account in full.

Pupil's Work.

Render an itemized bill, March 31.

Receipt the bill in full, April 2.

168.

Transactions.

April 10, 1886. Cheap Cash Store, Williamsburg. John Hopkins buys of Alfred Hunt, on account, 13 yds. Silk at \$1.95; 42½ yds. Sheeting at 18c.; 32 yds. Muslin at 12½c.; 6 pair Kid Gloves at \$1.37; 42 yds. Print at 9½c.; 22½ yds. Drilling at 14c.

May 12, 1886. John Hopkins pays his account in full.

Pupil's Work.

Render an itemized bill, April 30.

Receipt the bill in full, May 12.

169.

Transactions.

May 3, 1886. The Leading Grocery and Provision Store, Thomasville. Marshall Watson buys of C. E. Charters & Co., on account, 18 lbs. Sugar at 9c.; 12 lbs. Butter at 28c.; 3½ lbs. Tea at 70c.; 8½ lbs. Coffee at 34c.; 14 lbs. Biscuits at 11c.; 16 lbs. Soap at 14c.; 3½ lbs. Cheese at 18c.; 1½ doz. Eggs at 22c.

June 25, 1886. Marshall Watson pays his account in full.

Pupil's Work.

Render an itemized bill, May 31.

Receipt the bill in full, June 25.

170.

Transactions.

January 3, 1887. The Golden Lion, Niagara. Thomas Gibson buys of James Currie & Son, on account, 25 yds. Flannel at 36c.; 2 doz. Silk Buttons at 22c.; 13 yds. Muslin at 14c.; 16 yds. Sheeting at 18½c.; 2 Boys' Suits, \$9.50 and \$12.; 1 Overcoat, \$13.50; 2 Silk Ties at 75c.; ½ doz. Handkerchiefs at 16c. each; 14¼ yds. Velvet at \$2.40; 1 Fur Cap, \$2.75.

January 22, 1887. Thomas Gibson buys of James Currie & Son, on account, 35 yds. Tweed at \$1.20; 14 yds. Drilling at 12½c.

March 5, 1887. Thomas Gibson pays his account in full.

Pupil's Work.

Render an itemized bill, January 31.

Render a statement, February 28.

Receipt the statement in full, March 5.

171.

Transactions.

March 15, 1887. The Oak Hall Clothing Store, Topeka. Mrs. J. Adair buys of T. Crompton & Co., on account, 16 yds. Silk at \$3.25; 6 pair Hose at 62½c.; 2 pair Gloves at \$1.35; 13½ yds. Cambric at 12c.; 1 Umbrella, \$3.45.

March 22, 1887. Mrs. J. Adair buys of T. Crompton & Co., on account, 5 Handkerchiefs at 27½c.; 2 doz. Buttons at 37½c.

April 12, 1887. Mrs. J. Adair buys of T. Crompton & Co., on account, 15 yds. Ribbon at 26c.; 13 yds. Silk Velvet at \$3.25.

June 7, 1887. Mrs. J. Adair pays her account in full.

Pupil's Work.

Render an itemized bill, March 31.

Render a statement and new bill, April 30.

Render a statement, May 31.

Receipt the last statement, June 7.

172.

Transactions.

July 5, 1886. The Central Book Depot, Whitby. W. H. Huston buys of J. S. Robertson & Bros., on account, 3 quires Foolscap at 27c.; $5\frac{1}{2}$ quires Letter at 22c.; 1 McLellan's Algebra, \$1.75; 1 set Dickens, 12 vols., \$22.50; 3 Ancient Classics at 65c.

July 18, 1886. W. H. Huston buys of J. S. Robertson & Bros., on account, 15 Irving Library at 45c.; 6 quires Foolscap at $23\frac{1}{2}$ c.; 1 doz. Lead Pencils at 3c. each.

August 5, 1886. W. H. Huston buys of J. S. Robertson & Bros., on account, 3 Maury's Physical Geography at \$1.65.

August 10, 1886. W. H. Huston pays \$10 to apply on account.

September 12, 1886. W. H. Huston buys of J. S. Robertson & Bros., on account, 12 Drawing Books at $12\frac{1}{2}$ c.

October 14, 1886. W. H. Huston pays his account in full.

Pupil's Work.

Render an itemized account, July 31.

Render a statement, bill, etc., August 31.

Render a statement and bill, September 30.

Receipt this last statement in full, October 14.

173.

Transactions.

November 3, 1886. John Wallace buys of the Keewatin Lumber Co., on account, 1350 ft. Pine at \$32.50 per M.; 6250 ft. Hemlock at \$24.50 per M.; 3650 Cedar Posts at \$9.50 per C.

November 15, 1886. John Wallace buys of the Keewatin Lumber Co., on account, 4500 Shingles at \$4.40 per M.; 12,250 Fence Pickets at \$6.80 per M.

December 13, 1886. John Wallace pays \$122 on his account.

January 14, 1887. John Wallace pays \$35 on his account.

February 12, 1887. John Wallace pays the balance of his account in full.

Pupil's Work.

Render an itemized account, November 30.

Render a *credit* statement, December 31.

Render a *credit* statement, January 31.

Receipt this last statement in full, February 12.

174.

EXERCISE 167.—Robert Walker encloses the amount of his account in a letter to T. Myers & Co. Write the letter. Date, April 2.

EXERCISE 169.—Pupil, as C. E. Charters & Co's clerk. Write a short note to Marshall Watson, requesting a settlement of his account. Date, June 20.

EXERCISE 170.—Write a short note at the bottom of the statement of February 28, requesting payment.

EXERCISE 172.—Pupil, as W. H. Huston. Write a letter to J. S. Robertson & Bros., ordering the books, etc., named in the transaction of July 5.

EXERCISE 172.—Pupil, as J. S. Robertson & Bros' clerk. Answer the letter received from W. H. Huston, July 5.

EXERCISE 173.—Write a letter to John Wallace, enclosing statement of his account, and requesting an immediate settlement. Date, February 10.

V. REVIEW.**LOSS AND GAIN EXERCISES.**

175. A lumber dealer bought 32,450 feet of lumber at \$22 per M., and sold 11,750 feet at \$34 per M., and the remainder at \$28 per M. How much did he gain?

176. A grocer bought 100 loads of potatoes, of 30 bushels each, at $37\frac{1}{2}$ cents a bushel. Allowing $7\frac{1}{2}$ bushels for waste, how much will he gain by retailing the rest at 15 cents a peck?

177. A milk dealer buys 27 ten-gallon cans of milk each day at \$1.75 a can. He keeps three delivery wagons at an expense of \$1.75 each a day, and sells the milk at 7 cents a quart. Find his gain in ten weeks, including Sundays.

178. A fruit dealer bought 5 barrels of apples at \$2.75 a barrel. The 5 barrels contained 4956 apples. He sold them at the rate of 7 for 5 cents. How much did he gain?

179. A farmer bought 13 head of young cattle for \$215. He kept them for six months at an expense of \$3 a head per month, and then sold them at \$32 each. Did he gain or lose, and how much?

180. Three brothers chopped wood during 20 weeks of a certain winter. They averaged 7 cords a day. Their board cost \$2.50 a week each. They sold the wood at \$1.75 a cord. How much did each make?

181. A man bought a house and lot for \$7842. He built an addition to the house at a cost of \$1643. The house was destroyed by fire, and he received insurance \$3520. He then sold the lot for \$5215. How much did he lose?

182. A well digger agreed to dig a well upon the following terms: 40 cents for the first foot, 45 cents for the second, 50 cents for the third, 55 cents for the fourth, and so on to any depth. He paid a man \$1 a day to assist him. If it took him six days to dig the well 22 feet deep, and he paid 40 cents a day for board, how much did he make?

183. A merchant had goods on hand January 1, 1885, valued at \$12,324. He bought goods at a cost of \$7623, and sold goods to the amount of \$14,265 during the year. On December 31, 1885, his stock book showed goods on hand valued at \$8937. How much did he gain during the year?

184. Two farmers hired a steam thrasher for six months at \$22 a month. They were employed during 127 days of that time, and their expenses were \$3.25 a day. They thrashed 63,246 bushels of grain, for which they received $3\frac{1}{2}$ cents a bushel. How much did they make during the six months?

MISCELLANEOUS EXERCISES.

+ 185. Find the cost of 9600 sheets of paper at \$4.20 a ream.

186. How many hours from 10.15 a.m., Tuesday, until 7.45 p.m., Sunday?

187. One peck of clover seed will sow an acre. What will it cost to sow 8 acres, if the seed costs 11 cents a pound?

+ 188. A train passes a telegraph pole every 4 seconds. If the poles are 66 yards apart, how many miles an hour is the train going?

189. At 5 cents a quart, how much will a bushel of chestnuts cost?

+ 190. If a man's income is 5 cents a minute, what will be his total income during the three summer months?

+ 191. A schoolboy is 5 minutes late every day. How much time does he lose in 112 days?

192. A clock was 15 minutes fast at 11.30 a.m. on Monday. It lost time gradually, and was 10 minutes slow at 3.15 p.m. on Tuesday. At what time was it exactly right?

+ 193. A race course measures 1 fur. 8 rods 2 yds. 2 ft. How often must one go around it to travel 5 miles?

194. How many reams of paper are there in an edition of 6000 copies of a book of 160 pages, each sheet of the paper being folded four times?

+ 195. A dealer bought 5 gross of steel pens at \$1.50 a gross, and sold them at 15 cents a dozen. How much did he gain?

196. If one quart of nuts cost 11 cents, how many bushels can be bought for \$13.20?

197. A clock which gains 15 minutes in every 15 hours is right at noon on Monday. When will it again be right?

198. How much did I gain on 40 bushels of berries, bought at \$4 a bushel, and sold at 15 cents a quart?

199. Find the value of the rails in a straight fence 40 rods long, each rail being 11 feet long, and the fence 6 rails high, at \$22.50 per M.

200. A stationer buys 3 gross of lead pencils at \$3.75 a gross, and retails them at 7 cents each. How much does he gain on the lot?

201. Find the cost of 26,300 pounds of hay at \$14.50 a ton.

202. Water expands $\frac{1}{10}$ in freezing, and one cubic foot of water weighs 1000 ounces. Find the weight in tons of the ice 9 inches deep formed on a pond having an area of 3 acres.

203. There are 50 pupils in a room 36 feet long, 30 feet wide, and 15 feet high. How many cubic yards of air are there for each pupil?

204. How many half-pint bottles can be filled from a ten-gallon can of milk?

205. A man was born February 29, 1824, and died March 18, 1885. How many birthdays had he?

206. A horse requires three gallons of oats a day. When oats are worth 50 cents a bushel what will it cost to feed him during the months of December and January?

207. Show that if the price in pounds of laying a mile of rails be multiplied by 2 and divided by 11 the result is the price in farthings of laying a foot of rails.

208. How many bullets, each weighing $\frac{1}{2}$ oz., can be moulded from 2 pounds 4 ounces of lead?

209. A man bought 34,750 pounds of hay at \$15 a ton, and sold the same at 85 cents a hundredweight. How much did he gain?

210. If one bushel of wheat makes 40 pounds of flour, how many barrels of flour, containing 196 pounds each, ought a grain merchant to receive from 4263 bushels of wheat?

211. A drover bought 29 head of cattle for \$928, and sold them for \$1015. How much did he gain on each?

212. The wages of 20 men for 4 days is \$84. What is a man's daily wages?

213. Divide \$1976 among 15 persons, giving to four of them a double portion.

214. Twenty men can do a piece of work in 40 days. If 5 men assist them how long will it take?

215. A company of 45 men have victuals for 30 days. How many men must leave that the provisions may last 50 days?

216. Two trains start at the same time and place, and go in the same direction; the first goes 35 and the second 28 miles an hour. At the end of 25 hours the first begins to go in the opposite direction. In how many hours from the time of starting will they meet?

217. A man who can row 4 miles an hour in still water can row 2 miles down stream in 20 minutes. How long will it take him to row 2 miles up stream?

218. How many times can a vessel containing $3\frac{1}{2}$ quarts be filled from a barrel containing 105 gallons?

219. What number is that to which if $\frac{2}{5}$ of itself be added the sum will equal 77?

220. The H. C. F. of two numbers is 39, and their L. C. M. is 190905. One of the numbers is 2145; find the other.

221. Find the cost of 298,400 shingles at \$4.80 per M.

222. How many thirty-inch steps will a soldier take in marching $5\frac{1}{4}$ miles?

223. Find the value of 427 pounds of oat meal at 47 cents a stone.

224. A man has 2568 English crowns. How many Danish coins of the same name should he receive for them?

225. A horse and carriage are valued at \$350; $\frac{1}{3}$ of the value of the horse is equal to $\frac{1}{4}$ of the value of the carriage; find the value of each.

226. If 5s. be equal to \$1.22, find the value of £3 14s. 6d. in American currency.

227. The numerators of two fractions are 5 and 11, and $\frac{1}{2}$ the sum of the fractions is equal to $\frac{3}{4}$ of $\frac{1}{3}$. What are the fractions?

228. Find the value of 21 baskets of strawberries, each containing 14 quarts, at $12\frac{1}{2}$ cents a quart.

229. Find the value of 3 dressed hogs, weighing respectively $289\frac{1}{2}$ pounds, $211\frac{1}{2}$ pounds, and 234 pounds, at \$7.25 a hundred-weight.

230. A boat moves 17 feet 6 inches at each stroke. How far in miles will it move in 12,000 strokes?

231. How many days of 12 hours each will a man take to count a million gold dollars at the rate of 80 a minute?

232. If a grocer use a 15 ounce instead of a pound weight, how much does he cheat a customer who buys what he supposes to be 12 pounds of tea at 75 cents a pound?

233. How much must be paid in Canada for 85 hundredweight of oats at 75 cents a bushel?

234. If 5 square miles of land be equally divided among 48 settlers, how many acres will each have?

235. How many carats fine is a ring which is composed of $\frac{5}{8}$ pure gold?

236. A bought apples at the rate of 6 for 5 cents, and B bought oranges at the rate of 3 for 4 cents. How many oranges should B give A for 48 apples?

237. If you buy a pound of tea at 65 cents, 3 dozen eggs at 13 cents, 2 pounds of soda at 11 cents, 7 yards of ribbon at 24 cents, and a hat at \$1.25, and the merchant throws off 10 cents from every dollar's worth bought, how much change should you get out of a \$5 bill?

238. There are two numbers whose difference is 245, and whose sum is 965; find their product.

239. If telegraph poles cost 25 cents each, and wire $\frac{3}{4}$ of a cent a yard, how much will the material cost for 3 miles of telegraph line, consisting of 3 wires, the poles being 66 yards apart?

240. A locomotive burns a ton of coal while going 75 miles, and moves forward 10 yards every time the driving wheels turn round. How many times does the driving wheel revolve for every pound of coal burned?

241. Wheat has been bought at 85 cents a bushel. At what price per cental must it be sold so that after paying freight charges of 8 cents a bushel the gain may be $\frac{1}{5}$ of the entire cost?

242. A grain merchant shipped 8500 bushels of barley at a cost of 6 cents a bushel; he sold it at 75 cents, and gained \$340 on the lot. How much did he pay for each bushel?

243. There are 36 men employed on a job, all receiving the same wages; at the end of 42 days they receive \$3402. What does each man receive per day?

244. In what time will a boy, at 75 cents a day, earn as much as a man earns in 90 days at \$2.75 a day?

245. A number of cattle that cost \$9792 were sold for \$12,096, by which a profit of \$12 a head was made. How many head of cattle were there?

246. Find the cost of 9846 cedar rails at \$3.25 a hundred.

247. When a train is moving at the rate of 24 miles an hour, how long will it take it to pass 24 telegraph poles, the distance between the poles being 66 yards?

248. A merchant pays \$8.96 for butter at 24 cents a pound, but in buying, uses a weight of $16\frac{1}{2}$ ounces instead of a pound. In selling, he uses a weight $\frac{1}{4}$ of an ounce less than a pound. How much *dishonest* profit does he make by retailing the butter at 27 cents a pound?

249. A drover bought 247 sheep at \$4.75 each, and 42 more at \$4.40 each. Eight of them died, and he sold the rest at \$6 each. How much did he gain?

FOURTH DEPARTMENT.

I. SURFACE MEASUREMENT.

HINTS AND DEFINITIONS.

+ A **surface** has length and breadth without thickness.

A **rectangle** is a plane figure bounded by four straight lines, and having four right angles.

A rectangle is called a **square** when all its sides are equal.

The **area** of a rectangle is expressed by the product of the length and the breadth.

Before multiplying, it is necessary that both dimensions be expressed in units of the same denomination.

A **triangle** is a plane figure bounded by three straight lines.

The United States and Canadian **public lands** are divided, by lines running north and south, according to the true meridian, and by others crossing them at right angles, into **townships** six miles square.

Townships are sub-divided into **sections**, containing 640 acres, or one square mile each.

Sections are subdivided into *half-sections*, *quarter-sections* and *half-quarter-sections*.

PRACTICAL EXERCISES.

X 1. How many square inches in the surface of a table 9 feet by $4\frac{1}{2}$ feet?

X 2. How many square yards in a blackboard 32 feet long by $4\frac{1}{2}$ feet wide?

X 3. How many square rods in a garden 231 feet long by 165 feet wide?

X 4. Find the cost of a piece of oil cloth 24 feet long by 15 feet 9 inches wide at 85 cents a square yard.

X 5. What will it cost to cement a cellar bottom 36 feet long by 23 feet 7 inches wide at 96 cents a square yard?

6. Find the cost of painting a blackboard 23 feet long by 2 feet 3 inches wide at 48 cents a square yard.

7. What was the total cost of paving a street 1 mile long and $1\frac{1}{2}$ chains wide at 45 cents a square foot?

8. A rectangular garden is 48 yards long by 48 feet wide; what is its area in square yards?

9. How many yards of satin, $\frac{3}{4}$ yard wide, will it take to line $22\frac{1}{2}$ yards of velvet $\frac{1}{2}$ yard wide?

10. A certain city is 5 miles square. Its population is 211,200. How many square feet of land are there to each person?

DIRECTION.—The dimensions of rectangular pieces of ground are given, and the area of each in acres is to be found.

11. 36 rods by 40 rods.

16. 75 rods by 32 rods.

12. 25 rods by 60 rods.

17. 84 rods by 20 rods.

13. 80 rods by 36 rods.

18. 96 rods by 60 rods.

14. 16 rods by 10 rods.

19. 38 rods by 80 rods.

15. 48 rods by 50 rods.

20. 70 rods by 96 rods.

21. 24 chains by 10 chains.

31. 28 rods by 10 chains.

22. 36 chains by 25 chains.

32. 32 rods by 15 chains.

23. 96 chains by 55 chains.

33. 64 rods by 25 chains.

24. 50 chains by 49 chains.

34. 40 rods by 36 chains.

25. 39 chains by 70 chains.

35. 50 rods by 48 chains.

26. 75 chains by 96 chains.

36. 96 rods by 240 chains.

27. 25 chains by 19 chains.

37. 215 rods by 50 chains.

28. 27 chains by 65 chains.

38. 240 rods by 96 chains.

29. 63 chains by 35 chains.

39. 144 rods by 100 chains.

30. 48 chains by 95 chains.

40. 100 rods by 144 chains.

2. 41. How many square yards are there in the walls of a room 24 feet long, 15 feet wide, and 14 feet high?

42. If a rectangular field which contains 16 acres is 40 rods wide, how long is it?

43. A field containing 18 acres is 80 rods long. Find the cost of fencing it at \$1.25 a rod.

44. A rectangular field containing 27 acres is 30 rods wide. What will it cost to fence it at 5 cents a yard?

45. The perimeter of a rectangle is 400 feet. The difference between the length and breadth is 40 feet. Find the area.

3 46. How many acres of land in a half-quarter-section?

4 47. What are the dimensions in rods of a quarter-section of land?

5 48. Find the value of a township of land at the rate of \$120 for each half-section.

6 49. How many quarter-sections in a piece of land 16 miles long by 4 miles wide?

7 50. What is the value of the land in a piece of country 42 miles square at \$1.50 an acre?

II. SOLID MEASUREMENT.

HINTS AND DEFINITIONS.

A **solid** has length, breadth, and thickness, or height.

A **rectangular solid** is a body bounded by six rectangular surfaces.

If all the surfaces or faces of a rectangular solid are *equal*, it is called a **cube**.

The **volume** of a rectangular solid is expressed by the product of the length, breadth, and height.

The three given dimensions must be expressed in the units of the same denomination.

A cubic yard of earth is called a *load*.

The standard cordwood pile is 8 feet long, 4 feet high, and 4 feet wide, and hence contains $8 \times 4 \times 4$, or 128 cubic feet.

PRACTICAL EXERCISES.

51. How many cubic inches in a cube, one edge of which is 3 feet?

52. What is the volume of a solid 6 feet 4 inches long, 4 feet 6 inches wide, and 8 feet high?

53. How many cubic yards of earth must be removed in digging a cellar 12 feet long, 10 feet wide, and $5\frac{2}{3}$ feet deep?

54. A room is 25 feet long, 24 feet wide, and 18 feet 6 inches high. How many cubic feet of air does it contain?

55. What will it cost to dig a cellar 60 feet long, 48 feet wide, and 7 feet 4 inches deep, at 60 cents a load?

56. If a block of soap 3 inches long, 2 inches wide, and $1\frac{1}{2}$ inches thick weighs 8 ounces, what will be the weight in pounds of a cubical block of soap, each dimension of which is 3 feet?

57. How many cubic inches in 3 cords of wood?

58. How many cubic-inch blocks will it take to fill a mortise 14 inches long, 3 inches wide, and 6 inches deep?

59. How many cubic feet in a block of stone 15 feet long, 13 feet wide, and 14 feet thick?

60. How many cords of wood in a pile 12 feet long, 12 feet high, and 8 feet wide?

61. Find the value of a pile of tan-bark 120 feet long, 44 feet wide, and 16 feet high, at \$2.25 a cord.

62. Find the value of a pile of wood 242 feet long, 28 feet wide, and 12 feet high, at \$3.75 a cord.

63. A sleigh upon which four-foot wood is piled is 10 feet long. How high should the wood be piled to make two cords?

64. What should be the length of a cord of five-foot wood, 4 feet high?

65. What should be the length of a cord of three-foot wood, 6 feet high? 4 feet high?

66. A cord of $2\frac{1}{2}$ -foot wood is 6 feet long; how high is it?

67. Find the cost of a block of marble $6\frac{1}{2}$ feet long, 3 feet wide, and 2 feet 3 inches thick, at \$2.25 a cubic foot?

68. How many cut stones, each 8 inches by 4 inches by 5 inches, will it take to construct a wall one-half a mile long, 10 feet thick, and 27 feet high?

69. How many cords of wood can be piled into a woodshed 20 feet long, 18 feet wide, and 16 feet high?

NOTE.—A cubic foot of water weighs 1000 ounces.

70. What weight of water will a rectangular cistern contain, the length being 5 feet, the breadth $3\frac{1}{2}$ feet, and the depth 12 feet?

III. LUMBER MEASUREMENT.

HINTS AND DEFINITIONS.

Lumber, as the term is used here, includes boards, plank, scantling, joists, and sawed timber.

A **board foot** is the unit of measurement. It is one foot long, one foot wide, and one inch thick.

All lumber less than one inch in thickness is considered inch lumber in measuring.

To find the number of board feet, or feet of lumber in a board or plank, *multiply the length in feet by the width and thickness in inches, and divide the product by 12.*

PRACTICAL EXERCISES.

71. Find the number of board feet in a board—

1. 12 feet long, 12 inches wide, 1 inch thick.
2. 12 feet long, 10 inches wide, 1 inch thick.
3. 13 feet long, 18 inches wide, 1 inch thick.
4. 14 feet long, 7 inches wide, 1 inch thick.

72. Find the number of board feet in a plank—

1. 12 feet long, 18 inches wide, $1\frac{1}{2}$ inches thick.
2. 12 feet long, 14 inches wide, $1\frac{1}{2}$ inches thick.
3. 13 feet long, 16 inches wide, $1\frac{1}{4}$ inches thick.
4. 16 feet long, 13 inches wide, $1\frac{3}{4}$ inches thick.

73. Find the number of board feet in a plank—
1. 19 feet long, $12\frac{1}{2}$ inches wide, 2 inches thick.
 2. 18 feet long, $13\frac{1}{2}$ inches wide, 3 inches thick.
 3. 15 feet long, $14\frac{1}{2}$ inches wide, 2 inches thick.
 4. 16 feet long, $15\frac{1}{2}$ inches wide, 2 inches thick.
74. Find the number of board feet in a plank—
1. $9\frac{1}{2}$ feet long, 18 inches wide, $2\frac{1}{2}$ inches thick.
 2. $8\frac{1}{2}$ feet long, 16 inches wide, $3\frac{1}{2}$ inches thick.
 3. 7 feet long, 15 inches wide, $2\frac{1}{2}$ inches thick.
 4. 9 feet long, 9 inches wide, $3\frac{1}{4}$ inches thick.
75. Find the number of board feet in a scantling—
1. 10 feet long, 3 inches wide, $2\frac{1}{2}$ inches thick.
 2. 14 feet long, 4 inches wide, $3\frac{1}{4}$ inches thick.
 3. 16 feet long, 6 inches wide, $4\frac{1}{2}$ inches thick.
 4. 20 feet long, 5 inches wide, $3\frac{3}{4}$ inches thick.
76. At \$18 per thousand find the total cost of
- 2 boards 12 feet long, 2 feet wide, 1 inch thick.
 - 3 boards 14 feet long, $1\frac{1}{2}$ feet wide, $1\frac{1}{2}$ inches thick.
 - 4 boards 15 feet long, $2\frac{1}{4}$ feet wide, $1\frac{1}{4}$ inches thick.
77. At \$20 per thousand find the total cost of
- 3 planks 12 feet long, 14 inches wide, 2 inches thick.
 - 5 planks 18 feet long, 15 inches wide, 3 inches thick.
 - 7 planks 8 feet long, 12 inches wide, 2 inches thick.
78. At \$27.50 per thousand find the total cost of
- 5 scantlings 18 feet long, 4 inches wide, 3 inches thick.
 - 9 scantlings 14 feet long, 5 inches wide, 4 inches thick.
 - 8 scantlings 12 feet long, 6 inches wide, 5 inches thick.
79. How many feet of lumber in a stick of timber 36 feet long and 18 inches square?
80. How many feet of lumber in a floor 18 feet long by 15 feet wide, and 1 inch thick?
81. How many feet of lumber in a stick of timber 28 feet long and 20 inches square?

82. How many feet of lumber in a sidewalk 100 yards long, 6 feet wide, and $1\frac{1}{2}$ inches thick?

83. How many feet of lumber in a board fence 40 rods long, 5 feet high, and 1 inch thick?

84. Find the cost of 2346 feet of lumber at \$37.50 per thousand.

85. Find the cost of 6520 feet of flooring at \$64.25 per thousand.

86. Find the cost of 12 planks each 12 feet long, 12 inches wide, and 3 inches thick, at \$12 per thousand.

87. Find the cost of the lumber for a platform 220 feet long, 132 feet wide, and 2 inches thick, at \$24 per thousand.

88. How many board feet in a plank 14 feet long, 12 inches wide, and $3\frac{1}{2}$ inches thick?

89. What is the cost of 468 fence boards 16 feet long and 9 inches wide, at \$16 per thousand.

90. At \$22 per thousand find the cost of the lumber required to enclose a square ten-acre field with a board fence; the boards to be 11 feet long, 6 inches wide, and 1 inch thick, and the fence four boards high.

91. How much inch lumber will be required to cover a walk 4 feet wide around a rectangular garden 300 yards by 250 yards?

92. Find the cost of 26,340 feet of lumber at \$27.50 per thousand.

93. A bridge 132 yards long and 18 feet wide is covered with plank $2\frac{1}{2}$ inches thick. Find the value of the plank at \$18.50 per thousand.

94. Find the cost of 3 boards, each $\frac{3}{4}$ of an inch thick, 18 feet long, and 14 inches wide, at \$24 per thousand.

95. A plank sidewalk 18 feet wide and 2 inches thick is to be built around a block 5 chains square. What will the lumber cost at \$18 per thousand?

IV. BUILDING AND FURNISHING.

HINTS AND DEFINITIONS.

Excavations are estimated by the cubic yard.

Brickwork is usually estimated by the thousand bricks.

The dimensions of an ordinary brick are 8 inches by 4 inches by 2 inches.

For ordinary calculation it is sufficiently accurate to reckon 27 bricks to the cubic foot, laid dry, or 20 bricks laid in mortar.

Stonework is usually estimated by the *perch*, containing $24\frac{3}{4}$ cubic feet.

In estimating material, allowance is made for doors, windows, and corners. In estimating the work, the measure is usually taken on the outside of the walls.

To find the number of perches in a wall, divide the contents in cubic feet by $24\frac{3}{4}$.

To find the number of common bricks in a wall, multiply the contents in cubic feet by 20.

Plastering and **painting** are estimated by the square yard.

Carpet is usually either 27 inches or 36 inches wide.

PRACTICAL EXERCISES.

96. Find the cost of excavating a cellar 20 feet square and 6 feet deep at 90 cents a cubic yard.

97. What will it cost to build a stone wall 990 feet long, 3 feet wide, and 12 feet high, at \$7.50 a perch?

98. How many perches of masonry in a wall 9 feet high and 2 feet thick, enclosing a garden 13 rods long and 9 rods wide (outside measurement)?

99. How many bricks will be required to build a wall 224 feet long, 12 feet high, and 1 foot 6 inches thick?

100. What will it cost to plaster a room 32 feet long, 18 feet wide, and 13 feet high, at 12 cents a square yard, allowing 200 square feet for doors and windows?

101. How many yards of carpet, 27 inches wide, will be required for a hall 11 feet 3 inches wide and 64 feet long?

102. A pile of ordinary bricks is 8 feet 6 inches high, 14 feet long, and 15 feet wide. What is the pile worth at \$12.50 a thousand?

103. How many yards of wall paper 2 feet wide will be required for the sides of a hall 72 feet long and 14 feet high?

104. How many bricks laid in mortar will be required for a wall 120 feet long, 18 feet high, and 2 feet thick?

105. A stone wall contains 2970 cubic feet; find its cost at \$22 a perch.

106. A brick wall contains 2970 cubic feet; find its cost at \$18.50 per thousand bricks.

+ 107. Find the cost of plastering the walls and ceiling of a church 64 feet long, 48 feet wide, and 21 feet high, at 17 cents a yard, allowing 900 square feet for doors and windows.

108. A parlor 20 feet by 18 feet is carpeted with 36-inch carpet at \$1.20 a yard, surrounded by a carpet border one foot wide at 75 cents a yard. Find the total cost.

109. Two strips of moulding at $12\frac{1}{2}$ cents a foot are placed around a drawing room 24 feet by 16 feet. Find the cost?

110. The floor, walls and ceiling of a room 18 feet long, 16 feet wide, and $12\frac{1}{2}$ feet high, are made of inlaid walnut, oak, and rosewood. Find the cost of the work at \$2.50 a square foot for labor, and \$75 a thousand for lumber, surface measurement.

111. How many shingles, laid 4 inches to the weather, will be required for the roof of a barn each side of which is 32 feet wide and 100 feet long.

NOTE.—One thousand shingles, laid 4 inches to the weather, will cover 100 square feet of surface.

112. If one thousand laths cover 70 yards of surface, and 11 pounds of lath nails nail them on, what will it cost to lath the walls and ceiling of a school house 42 feet long, 30 feet wide, and 14 feet high, at \$2 a thousand for laths, 6 cents a pound for nails, and $3\frac{1}{2}$ cents a yard for labor?

+ 113. Find the cost of a piece of oil cloth $22\frac{1}{2}$ feet by $17\frac{1}{2}$ feet at 63 cents a square yard.

+ 114. What will it cost to carpet a room 15 feet 9 inches by 12 feet 6 inches with carpet 27 inches wide at \$1.50 a yard?

V. THE METRIC SYSTEM.

HINTS AND DEFINITIONS.

The **metric system** is a system of weights and measures based upon the *decimal notation*.

The unit of measure for length is a meter; and from this are derived the units of surface, volume, and weight.

The **standard meter** is the length of a bar of very hard metal, carefully preserved at Paris. It is about 39.37 inches in length.

The principal units of measure are, the **meter** for lengths, the **square meter** for surfaces, the **cubic meter** for large volumes, the **liter** for smaller volumes, and the **gram** for weights.

LINEAR MEASURE:—

A millimeter = .001 of a meter.

A centimeter = .01 of a meter.

A meter **Principal unit.**

A kilometer = 1000 meters.

MEASURES OF SURFACE:—

A square centimeter = .0001 of a square meter.

A square meter **Principal unit.**

A square dekameter = 100 square meters.

A square kilometer = 1,000,000 square meters.

MEASURES OF VOLUME:—

A cubic centimeter = .000001 of a cubic meter.

A cubic decimeter = .001 of a cubic meter.

A cubic meter **Principal unit.**

MEASURES OF WEIGHT:—

A milligram = .001 of a gram.

A gram **Principal unit.**

A kilogram = 1000 grams.

A metric ton = 1000 kilograms.

In the measurement of land, a square dekameter is called an **are**. One hundred **ares** = one **hectare**, which is equal to about 2.47 acres.

In measuring wood the cubic meter is called a **ster**.

In measuring liquids, grain, etc., the **cubic decimeter** is always called a **liter**.

A **cubic centimeter** of water weighs a **gram**.

A **liter** of water weighs a **kilogram**.

A **cubic meter** of water weighs a **metric ton**.

NOTE.—To complete the above tables several other denominations should be added, but as these are rarely used they have been omitted.

PRACTICAL EXERCISES.

115. How many centimeters in 3 kilometers?
116. The surface of a cubic meter contains how many square centimeters?
117. How many grams in a metric ton?
118. What is the value of 60 centimeters of cloth at \$5.20 a meter?
119. A train runs 288 kilometers in 9 hours, how many meters does it run in a minute?
120. How many square meters in 12 ares?
121. How many cubic centimeters in .016 cubic meters?
122. How many liters in 3.7 cubic meters?
123. Give the weight in kilograms of .3243 cubic meters of water.
124. Find the area of a rectangular field 3 kilometers long by 2 kilometers wide.
125. A pile of wood is 3.5 kilometers long, 3.5 meters wide, and 320 centimeters high. Find its value at 75 cents a ster.
126. Find the area of the walls of a room whose length is 7 meters, breadth 5.2 meters, and height 4 meters.
127. How many cubic meters in a block 9 centimeters long, 8 centimeters wide, and 7 centimeters deep?
128. A man buys a ton (metric) of potatoes for \$24, and retails them at 5 cents a kilogram. What profit does he make?
129. What is the weight of water required to fill a vat 90 centimeters long, 64 centimeters wide, and 36 centimeters deep?
130. A liter of air weighs 1.273 grains. How much does a cubic meter of air weigh?
131. If firewood is cut 1.16 meters long, what height must the sides of the ster be to hold a cubic meter?

132. What is the value of a kilometer of silk at \$1.75 a meter?

133. In 53 ares how many square meters?

134. How many square meters in a building lot 9 meters by 28 meters?

135. How many cubic meters in a box 4.7 meters by 5.6 meters by 7.3 meters?

136. A pile of wood containing 432 sters is 2.5 meters high and two meters wide. How long is it?

137. How many liters in a vessel whose capacity is 3 cubic meters?

138. What is the weight in grams of 5 cubic meters of water?

139. Find the value of the gold leaf, at 3 cents a square centimeter, required to cover the surface of a cubic decimeter.

VI. REVIEW.

MISCELLANEOUS DRILL EXERCISES.

140. Make six different numbers with the figures 3, 9, and 8, and find their sum.

141. Subtract 3 from every number between 10 and 30, and then find the sum of the remainders.

142. Starting at Chicago I go 200 miles due west, then 150 miles due north, then 100 miles due east, then 350 miles due south, then 100 miles due east, then 150 miles due north. How far from Chicago am I now? What direction from the city am I?

143. The remainder is 302105. If both subtrahend and minuend be multiplied by 101, what will the remainder be?

144. Pure milk is worth 7 cents a quart. If 2 quarts of water be mixed with every 3 gallons of milk, what will a quart of the mixture be worth?

145. How many days between March 7 and November 23?

146. The sum of the remainder and subtrahend is 100190801. Find 20101 times the minuend.

147. What number must be subtracted from $\frac{1}{4}$ to leave .05?

148. What number subtracted 88 times from 80005 will leave 13 as a remainder?

+ 149. If 11 men can build a wall in 18 days, how many men will it take to build a wall three times as long in half the time?

150. How many minutes are there between 35 minutes past 7 in the morning and midnight?

151. What will 3240 feet of lumber cost at \$22.50 per M.?

+ 152. How long will it take a train to go 352 miles at the rate of 2640 feet a minute?

153. What is the nearest number to 10050 that will contain 207 without a remainder?

154. How long will it take 3 men to do what 5 men can do in 30 days?

155. Find the prime factors of 61200.

156. The H. C. F. of two numbers is 15, and their L. C. M. is 450. What are the numbers?

+ 157. If a train moves 48 feet in a second, what is its rate in miles per hour?

+ 158. Four-foot wood is piled to a height of $6\frac{1}{2}$ feet. How long must the pile be to contain 3 cords?

159. Find in American currency the total value of 22 sovereigns, 13 half-sovereigns, 14 crowns, 22 half-crowns, and 64 shillings.

160. Reduce £5.375 to pounds, shillings, and pence.

161. Reduce £12 18s. 6d. to dollars and cents.

162. Of a mixture of milk and water, $\frac{3}{8}$ of the weight is water. How many ounces of water in a pound of the mixture?

163. A pint of water is put into a gallon of milk. What part of the mixture is water?

164. Subtract 23 from each prime number between 30 and 50, and then find the continued product of the remainders.

165. At the rate of $124\frac{1}{2}$ rods a minute how many hours will a train be in going from Boston to Buffalo, a distance of 498 miles?

X 166. How many miles an hour does a person walk who takes 2 steps a second and 1800 steps in a mile?

167. A train runs from New York to Philadelphia, 90 miles, in 1 hour 40 minutes. What is its rate per hour?

168. A horse traveled $5\frac{1}{2}$ miles in 33 minutes. What was his average time per mile?

169. A can mow $\frac{3}{4}$ of a field in 6 days; B can mow $\frac{2}{3}$ of it in 4 days. How long will it take both to mow the field?

X 170. If $\frac{2}{3}$ of a piece of work be done in 28 days, how much will be done in $4\frac{1}{3}$ days.

171. What length of road $49\frac{1}{2}$ feet wide will contain an acre?

172. How many sods, each 2 feet 6 inches by 10 inches, will be required to sod an acre of ground?

173. Find the cost of half an acre of ground at 63 cents per square yard.

174. How many days will 19,734 pounds of hay last 17 horses, if each horse eats 33 pounds a day?

X 175. Simplify $2\frac{1}{2} \times \frac{3}{5} \times 5\frac{1}{3} \times \frac{3}{4} \times \frac{2}{3}$ of $\frac{3}{7} \times 3\frac{1}{2}$.

176. How many lots of $\frac{1}{4}$ acre each can be made out of a piece of village of property 45 chains square?

177. Find the cost of 2064 pounds of wheat at 75 cents per bushel.

X 178. From $\frac{3}{4}$ of a score take the difference between $\frac{1}{10}$ of a hundred and $\frac{2}{3}$ of a dozen.

179. A piece of cloth, when measured with a yard measure that is $\frac{3}{4}$ of an inch short, appears to be 141 yards long. What is its true length?

180. Find a man's wages for 4 weeks 3 days 6 hours at \$12 a week, reckoning 6 days to a week and 10 hours to a day.

181. Divide \$2652 into three parts, in the ratio of 6, 4, and 3.

182. A and B together have \$136, and $\frac{2}{3}$ of A's money is equal to $\frac{3}{4}$ of B's. How much has each?

183. How many rods of fence will be required to enclose a field in the shape of a rectangle, one side of which is 64 rods, and containing 20 acres?

184. Find the cost of 3920 bricks at \$8.40 per M.

185. How many ties will it take for 20 miles of railway track, each yard requiring 1 tie?

186. How many square yards in the ceiling, walls, and floor of a room 28 feet long, 24 feet wide, and 18 feet high?

187. Find the cost of a scantling 4 inches by $8\frac{1}{2}$ inches, and 22 feet long, at \$18 per M.

188. What will it cost to floor a room 16 feet long and 12 feet wide at \$14.50 per square of 100 square feet?

189. What will it cost to paint the walls and ceiling of a hall 48 feet long, 27 feet wide, and 18 feet high, at \$1.20 per square yard?

190. What will it cost to slate a roof 44 feet by 35 feet at \$5.75 per square of 100 square feet?

191. What will it cost to paint the floor of a room 20 feet by 24 feet at 22 cents per square yard?

192. What will it cost to plaster a room 16 feet by 20 feet, and 15 feet high, at 18 cents per square yard, allowing $\frac{1}{10}$ for doors and windows?

193. How many square feet in a walk 4 feet wide, surrounding a rectangular garden 50 feet by 42 feet?

194. How many feet of lumber in a close board fence 6 feet high, 1 inch thick, and 2 miles long?

195. If a field 50 rods long contains 10 acres, how wide is the field?

196. If a field 200 yards wide contains 15 acres, how long is it?

197. How many planks 10 inches wide and $13\frac{1}{2}$ feet long will it take to make a sidewalk 600 feet long and $4\frac{1}{2}$ feet wide?

198. If each man occupies a space of 27 inches by 20 inches, how many men can stand in a room 36 feet by 40 feet?

199. How many trees are there in a wood a half a mile square, if there are on an average 8 trees to a square chain?

200. A reservoir is 40 feet 6 inches long and 21 feet 4 inches wide. How many cubic feet of water must be drawn off to lower the surface 5 inches?

201. How many posts placed 8 feet apart will it take to go around a quarter-section of land?

202. How many cords of wood can be piled in a shed 72 feet long, 48 feet wide, and 16 feet high?

203. At 26 cents a cubic yard what will it cost to dig a cellar 36 feet long, 28 feet wide, and 7 feet deep?

204. Find the length in inches of the edge of the largest square marble slab that can be used in flooring a room 33 feet 10 inches long and 24 feet 6 inches wide.

205. From a lot 80 rods square I sold 80 square rods. What is the value of the remainder at \$150 an acre?

206. The area of a certain floor is 1024 square feet. The length is 4 times the breadth. What are its dimensions?

207. How many sods, each 8 inches square, will be required to sod a yard 24 feet long and 10 feet 8 inches wide?

208. A's farm is $\frac{1}{2}$ mile square, B's contains $\frac{1}{2}$ of a square mile, and C's is $\frac{1}{4}$ larger than A's and B's together. How many acres in C's farm?

209. At 36 cents a square yard how much will it cost to plaster the walls and ceiling of a room 18 feet long, 16 feet wide, and $9\frac{1}{2}$ feet high, allowing 73 square feet for windows and door?

210. The inside dimensions of a rectangular fort are 210 feet and 180 feet. The stone wall surrounding this space is 5 feet thick and 12 feet high. How many cubic feet of masonry are there in the wall?

211. Find the value of the lumber at \$18 per M. that will be required to build 500 yards of plank sidewalk 10 feet wide, 2 inches thick, and resting on 3 continuous lines of scantling 4 inches square.

212. Find the cost of a pile of lumber 16 feet long, 3 feet 3 inches wide, and 5 feet 6 inches high, at \$22.50 per M.

213. A contractor undertakes to dig a ditch $3\frac{1}{2}$ miles long, 12 feet wide at the top, 6 feet wide at the bottom, and 5 feet deep, for 25 cents per cubic yard. How much money should he receive for the work?

214. The length of a rectangular field whose area is $3\frac{2}{3}$ acres is to its width as 16 is to 9. Find the cost of fencing it at \$1.50 per rod.

215. A man has a square field containing 10 acres. How many furrows must he plough across it to make an acre, supposing each furrow to be 8 inches wide?

216. A map is drawn on a scale of 10 miles to an inch, and a township is represented on it by a square whose side is half an inch. How many acres in the township?

+ 217. How long must a lot be to contain $\frac{1}{3}$ of an acre, if it is 88 feet wide?

218. Trees are planted 12 feet apart around the sides of a rectangular field 40 rods long, containing 2 acres. Find the number of trees.

219. A square yard is cut from a board 18 feet long and 10 inches wide. Find the length of the remainder?

220. A garden, 180 feet long by 150 feet wide, is surrounded by a tight board fence 6 feet high. What will it cost to paint the fence, both sides, at 12 cents per square yard?

221. How many square miles of country will be represented by a map $10\frac{1}{2}$ inches long and 6 inches wide, drawn on a scale of 3 miles (in length) to an inch?

222. A boy takes 924 steps of $2\frac{1}{2}$ feet each to walk round a field 40 rods long. How many acres in the field?

223. A farmer has a bin 18 feet long, 10 feet wide, 6 feet deep, that is $\frac{3}{4}$ full of wheat. What is the wheat worth at \$2 a bushel?

NOTE.—A bushel contains $2150\frac{1}{2}$ cubic inches.

224. I want to cut an acre of land from a long, narrow field, which is 55 yards broad. What length of it must I take?

225. There are 107 square yards in the surface of the walls and ceiling of a room 15 feet by 18 feet. How high is the room?

226. A gallon of paint, worth \$1.75, covers 200 square feet. What will it cost to paint a tight board fence 4 feet high, which encloses a lot 8 rods by 12 rods?

227. What must be the width of a box 6 feet long, 4 feet high, to contain $\frac{3}{4}$ of a cord of wood?

228. A map 6 feet long and 4 feet broad represents 13,824 square miles of the earth's surface. To what scale is it drawn?

229. How many bushels of wheat in a bin 391 inches long, 11 feet wide, and filled $4\frac{1}{2}$ feet deep?

230. A grocer received pay at 72 cents a pound for what he supposed to be $5\frac{1}{2}$ pounds of tea. His pound weight was one-half ounce too heavy. How much money should he have received?

231. How many bushels of barley will weigh as much as 690 bushels of corn?

232. How many square yards of block pavement in a street $\frac{1}{2}$ a mile long and $1\frac{1}{2}$ chains wide?

233. A man divided his money among his five sons. He gave $\frac{1}{2}$ to the eldest, $\frac{1}{3}$ of what was left to the second, $\frac{2}{5}$ of what was then left to the third, $\frac{3}{7}$ of what was then left to the fourth, and the remainder, which was \$280, to the fifth. How much money was divided?

NOTE.—Multiply the complements of the several fractions together to find the fifth fraction. Thus the complements are $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{4}{7}$, and the product of these fractions equals $\frac{4}{35}$ the fifth son's share.

234. A merchant mixes 22 pounds of coffee worth 45 cents with 18 pounds worth 50 cents. What is a pound of the mixture worth?

235. If 24 men can do a work in 14 days of 9 hours, how many men will do it in 12 days of 7 hours?

236. A can run 10 yards to B's 9. How many yards' start must A give B to make an even race?

237. A garrison of 2000 men has provisions for 60 days. At the end of 20 days a reinforcement arrives, and then the provisions last only 5 days. What is the number of the reinforcement?

238. If a man rows 10 miles in $2\frac{1}{2}$ hours against a stream, the rate of which is 3 miles an hour, how long will he be rowing 5 miles with the stream?

239. If the shadow of an upright pole 9 feet high is $8\frac{1}{2}$ feet, what will be the height of a church spire which casts a shadow 221 feet long?

240. Show that the highest common factor of two numbers is the least common multiple of all their common measures.

241. A can do $\frac{2}{3}$ of a piece of work in 8 hours, and B can do $\frac{3}{4}$ of the remainder in 2 hours, and C can finish it in 40 minutes, in what time will they do it, all working together?

242. By using false weights a grocer receives 33 cents instead of 32 cents. Find the number of ounces in his false pound.

243. Find the number of feet, board measure, in 25 joists, each 6 inches by 5 inches, and 18 feet long.

MISCELLANEOUS BUSINESS EXERCISES.

244. Cash.—On hand at the beginning of the day, \$572.20. Received during the day, \$425.95. Paid, \$65.80. What is the cash balance at the end of the day?

245. Cash.—On hand at the beginning of the day, \$273.87. Received during the day, \$243.10. On hand at the close of the day, \$362.42. How much was paid?

246. Cash.—On hand at the beginning of the day, \$5200.25. Paid during the day, \$353.98. On hand at the close of the day, \$6056.83. How much was received?

247. Cash.—Received during the day, \$10.23. Paid during the day, \$15.63. On hand at the close of the day, \$2.45. How much was on hand at the beginning of the day?

248. Cash.—On hand January 1, \$240. On deposit in the Merchants' Bank, \$524.80. Received during January, \$485.50. Paid during January, \$562.80. Deposited cash, \$55. Find the amount of cash on hand and the amount on deposit January 31.

DIRECTION.—Fill the blanks below with the answers to Exercise 248.

249. Cash.—On hand February 1, —. On deposit in the Merchants' Bank —. Received during January, \$329.84. Paid during January, \$134.15. Deposited, \$124. Find the amount of cash on hand and the amount on deposit February 28.

250. Cash.—On hand March 1, —. On deposit in the Merchants' Bank, —. Received during March, \$463.42. Paid during March, \$69.34. Deposited, \$510.45. Find the amount of cash on hand and the amount on deposit March 31.

251. Merchandise.—On hand at the beginning of the year, \$1428. Bought during the year, \$2143. Sold during the year, \$3627. None on hand. Find the gain or loss.

252. Merchandise.—None on hand at the beginning of the year. Bought during the year, \$4215.74. Sold during the year, \$1565.85. On hand at the close of the year, \$2742.79. Find the gain or loss.

253. Merchandise.—On hand at the beginning of the year, \$2431.20. Bought during the year, \$3142.80. Sold during the year, \$5117.35. None on hand. Find the gain or loss.

254. Merchandise.—On hand at the beginning of the year, \$31,243.84. None bought during the year. Sold during the year, \$17,342.96. On hand at the close of the year, \$16,399.13. Find the gain or loss.

255. Merchandise.—None on hand at the beginning of the year. Bought during the year, \$13,242.87. Sold during the year, \$9836.44. On hand at the close of the year, \$5241.54. Find the gain or loss.

256. Merchandise.—On hand at the beginning of the year, \$7246.24. Bought during the year, \$3624.87. Sold during the year, \$8319.54. On hand at the close of the year, \$2143.82. Find the gain or loss.

257. Merchandise.—On hand at the beginning of the year, \$16,120.25. Bought during the year, \$5321.70. Sold during the year, \$13,617.18. On hand at the close of the year, \$125.18. Find the gain or loss.

258. Hardware.—On hand January 1, \$15.624. None bought during the year. Sold during the year, \$7,342.94. On hand at the close of the year, \$6524. Find the gain or loss.

259. Boots and Shoes.—On hand January 1, boots and shoes valued at \$5921.47, and stock valued at \$2320. Bought during the year, boots and shoes at a cost of \$3462. Manufactured the stock into boots and shoes at an expense of \$1462. Sold during the year, \$9634. Gave free to friends goods valued at \$145. On hand at the close of the year, boots and shoes valued at \$4964. Find the gain or loss.

260. Real Estate.—Owned at the beginning of the year property valued at \$15,620. Bought during the year property amounting to \$6540. Sold during the year property amounting to \$12,400. Value of property on hand at the close of the year, \$9020. Find the gain or loss.

261. Real Estate.—Owned on January 1, 1884, property valued at \$5621. Bought during the year, \$9846. Property destroyed by fire during the year, \$1276. Sold during the year, \$7263. On hand December 31, \$5364. Find the gain or loss.

262. Real Estate.—Owned at the beginning of the year, \$16,324. Bought during the year, \$11,372. Property destroyed by fire during the year, \$3621. Sold during the year, \$20,115. On hand at the close of the year, \$6389. Received insurance on property destroyed, \$1225. Find the gain or loss.

263. Dry Goods.—On hand at the beginning of the year, \$12,248.50. Received free, from a friend, goods valued at \$4200. Sold during the year, \$16,240. On hand at the close of the year, \$1,142.85. Find the gain or loss.

264. Groceries.—On hand at the beginning of the year groceries valued at \$9324.80. Bought during the year, \$2421.75. Groceries destroyed by fire during the year, \$1314. Sold during the year, \$8465.25. On hand at the close of the year, \$3652.80. Find the gain or loss.

265. Provisions.—None on hand at the beginning of the year. Bought during the year, \$7321.75. Provisions destroyed by fire, \$984.20. Sold during the year, \$4241.80. Received insurance, \$500. On hand at the close of the year, \$2115.90. Find the gain or loss.

266. Lumber.—On hand at the beginning of the year, lumber and logs valued at \$4620. Bought during the year, logs at a cost of \$3610. Manufactured lumber valued at \$7956, at an expense for labor of \$810. Sold lumber during the year, \$8650. Lumber and logs on hand December 31 are valued at \$5625. Find the gain or loss.

267. Furniture.—On hand at the beginning of the year, \$4935.55. Bought during the year, \$7428.40. Sold during the year, \$8420.90. Furniture destroyed by fire during the year, \$1049. On hand at the close of the year, furniture valued at \$5620. Received insurance on furniture destroyed, \$850. Paid insurance expenses, \$25. Find the gain or loss.

FIFTH DEPARTMENT.

I. PERCENTAGE.

HINTS AND DEFINITIONS.

The term **percentage** is applied to certain arithmetical exercises in which 100 is used as the basis of computation.

Per cent is an abbreviation of the Latin *per centum*, meaning *by the hundred*.

The **sign** % is used for the words *per cent*.

The **base** is the number on which the percentage is computed.

The **rate per cent** is the number which denotes how many hundredths of the base are to be taken.

Fractional Equivalents.

$$50\% = .50 = \frac{1}{2}.$$

$$33\frac{1}{3}\% = .33\frac{1}{3} = \frac{1}{3}.$$

$$25\% = .25 = \frac{1}{4}.$$

$$20\% = .20 = \frac{1}{5}.$$

$$16\frac{2}{3}\% = .16\frac{2}{3} = \frac{1}{6}.$$

$$12\frac{1}{2}\% = .12\frac{1}{2} = \frac{1}{8}.$$

$$10\% = .10 = \frac{1}{10}.$$

$$8\frac{1}{3}\% = .08\frac{1}{3} = \frac{1}{12}.$$

$$6\frac{1}{4}\% = .06\frac{1}{4} = \frac{1}{16}.$$

$$5\% = .05 = \frac{1}{20}.$$

$$3\frac{1}{5}\% = .03\frac{1}{5} = \frac{1}{30}.$$

$$2\frac{1}{2}\% = .02\frac{1}{2} = \frac{1}{40}.$$

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

- | | |
|------------------------------------|--------------------------------------|
| 1. What is $\frac{1}{3}$ of 396? | 11. Find $8\frac{1}{3}\%$ of \$672. |
| 2. What is $\frac{1}{4}$ of 488? | 12. Find 25% of \$480. |
| 3. What is $\frac{1}{5}$ of 595? | 13. Find 20% of \$560. |
| 4. What is $\frac{1}{6}$ of 966? | 14. Find 10% of \$327. |
| 5. What is $\frac{1}{8}$ of 968? | 15. Find 75% of \$244. |
| 6. What is $\frac{3}{4}$ of 428? | 16. Find 60% of \$720. |
| 7. What is $\frac{2}{5}$ of 535? | 17. Find $33\frac{1}{3}\%$ of \$792. |
| 8. What is $\frac{2}{3}$ of 816? | 18. Find $16\frac{2}{3}\%$ of \$624. |
| 9. What is $\frac{1}{10}$ of 950? | 19. Find $12\frac{1}{2}\%$ of \$848. |
| 10. What is $\frac{1}{12}$ of 732? | 20. Find $37\frac{1}{2}\%$ of \$960. |

WRITTEN DRILL EXERCISES.

21. What fraction of 88 is 11? What per cent?
22. What fraction of \$200 is \$5? What per cent?
23. What is the difference between $2\frac{1}{2}\%$ and $3\frac{1}{2}\%$ of \$800?
24. A clerk who received \$325 a year had his salary raised 40%. What does he receive now?
25. Some property which cost \$3256 increased in value 125%. What was the increased value?
26. A regiment went into battle with 1050 men, and came out with 588 men. What per cent was lost?
27. The rent of a house is \$330, which is 11% of its value. What is its value?
28. A merchant sold \$4800 worth of goods, and had $33\frac{1}{3}\%$ of his stock left. What was his entire stock worth?
29. A lawyer collected \$3264, and charged 5% for his services. How much did he pay over?
30. Ten years ago the population of a city was 32,480. It has increased 20%. What is its present population?
31. An estate agent sells a house and lot for \$8565, and receives 6% for his services. How much money does he receive?
32. A horse that cost \$220 was sold for \$242. What was the gain per cent.
33. A farm was sold for \$7490, which was $16\frac{2}{3}\%$ more than it cost. What did it cost?
34. What number increased by $\frac{1}{4}$ of 25% of itself equals 867?
35. Ten years ago the population of a city was 26,275. Its present population is 31,530. Find the increase per cent.
36. If gunpowder contains 75% of saltpetre, 10% of sulphur, and 15% of charcoal, how many pounds of each are there in a ton of powder?

37. A dealer sold 120 barrels of flour for \$792, which was 12% less than he paid for it. What did he pay per barrel?

38. A town, after decreasing 11%, has 4539 inhabitants. How many inhabitants had it at first?

39. A farmer sold 32 sheep for \$128, which was $33\frac{1}{3}\%$ more than he paid for them. What did he pay per head?

40. If goods are bought for \$8728 and sold for \$9819, what is the gain per cent?

41. A farmer buys 18 head of cattle at \$25 per head, and after losing 3 sells the remainder at \$33 per head. How much does he gain per cent?

42. Teas at 59 cents, 65 cents, and 76 cents per pound, are mixed in equal quantities and sold at \$1 per pound. Find the gain per cent?

43. If to 48 gallons of wine 2 gallons of water are added, what per cent of the mixture is water?

44. If to 64 gallons of alcohol 16 gallons of water are added, what per cent of the mixture is alcohol?

45. By selling a farm for \$3500 the owner will lose $12\frac{1}{2}\%$. What will be gained per cent by selling the farm for \$5000?

46. A merchant marks an article \$2.80, but takes off 5% for cash. If his profit is 33%, what was the cost of the article?

47. What would a dishonest dealer gain per cent by using a weight of 15 ounces instead of a pound?

48. What per cent above cost must a man mark his goods in order that he may take off 10% from the marked price and still make 20% on the cost.

49. If, by selling goods for $16\frac{2}{3}\%$ profit, a merchant clears \$749, what was the cost of the goods?

50. A dry article was exposed to damp air and absorbed 4 ounces of water; it then weighed 9 pounds. What per cent of its present weight is water?

51. By selling a farm for \$2340 an estate dealer lost 10% of the cost. What ought he to have sold it for to make 10%?

52. If resin is melted with $33\frac{1}{3}\%$ of its weight of tallow, what per cent of tallow does the mixture contain?

53. How many gallons of water must be mixed with $29\frac{1}{2}$ gallons of wine in order that the mixture may contain $17\frac{1}{2}\%$ of water?

54. A merchant increases his capital annually by 20% of itself. At the end of four years his capital is \$95,040. What was his capital at first?

55. The sum of 10% of a number and 5% of half the remainder is what per cent of a quarter of the number?

56. A quantity of sugar was sold at 10% gain. If it had cost \$120 more the same selling price would have entailed a loss of 10%. Find the cost of the sugar.

II. TRADE DISCOUNT.

HINTS AND DEFINITIONS.

When a reduction is made from the *nominal* price of an article, from the amount of a debt, or from the face of a note, it is called a **discount**.

Some kinds of merchandise—books, furniture, musical instruments, etc.—have fixed prices. Manufacturers and wholesale dealers invoice such merchandise to the trade, or retail dealers, at the fixed or **list prices**.

The list prices are usually the retailer's selling prices.

The manufacturer or wholesale dealer allows the retailer a **trade discount**, which is deducted at a certain rate per cent from the face of the invoice.

The amount of the discount allowed depends sometimes upon the amount of the order, and sometimes upon the terms of settlement.

Very often two or more discounts are deducted in succession. Thus 10% and 5% off, or as it is generally expressed in business, 10 and 5 off, means a discount of 10%, and then 5% from what is left; 20, 10, and 5 off means three successive discounts.

A retailer's profit is smaller when he is allowed 10% and 5% off than if he were allowed 15% off.

The result is not affected by the order in which the discounts are taken.

ILLUSTRATIVE EXERCISES.

1. Goods are invoiced at \$80, less 20% and 10%. What do they cost?

\$80.00	
<u>16.00</u>	Multiply by 2 and carry one place to the right.
\$64.00	
<u>6.40</u>	Multiply by 1 and carry one place to the right.
\$57.60	<i>Ans.</i>

To take 10%, 20%, 30%, 40%, etc., of a number, multiply the number by 1, 2, 3, 4, etc., and divide the product by 10.

2. Goods are invoiced at \$243.27, with 40, 20, and 5 off. Find the cost.

\$243.27	
<u>97.30</u>	8 Multiply by 4 and carry one place to the right.
\$145.96	
<u>29.19</u>	2 Multiply by 2 and carry one place to the right.
\$116.77	
<u>5.83</u>	8 Take half and carry two places to the right.
\$110.93	<i>Ans.</i>

In the \$97.308 above, omit the 8 and add 1, making 31 cents. In the \$29.192, omit the 2. In the \$5.838, omit the 8 and add 1, making 84 cents. In all such cases, if the decimal is 5 or more, add 1 cent; if less than 5, omit it entirely.

3. Goods are invoiced at \$324.45, with $33\frac{1}{3}$, $2\frac{1}{2}$, and 1 off. Find the cost.

\$324.45	
<u>108.15</u>	Take one-third.
\$216.30	
<u>5.41</u>	Take one-fourth and carry two places to the right.
\$210.89	
<u>2.11</u>	Multiply by 1 and carry two places to the right
\$208.78	<i>Ans.</i>

4. Goods are invoiced at \$236.18, with 40, 6, and $\frac{1}{2}$ off. Find the cost.

\$236.18	
94.47	Multiply by 4 and carry one place to the right.
<hr/>	
\$141.71	
8.50	Multiply by 6 and carry two places to the right.
<hr/>	
\$133.21	
.67	Multiply by $\frac{1}{2}$ and carry two places to the right.
<hr/>	
\$132.54	<i>Ans.</i>

BUSINESS EXERCISES.

DIRECTION.—Find the cost price.

57. List price, \$248. Trade discount, 5 and 20 off.
58. List price, \$380. Trade discount, 5 and 30 off.
59. List price, \$340. Trade discount, 30 and 5 off.
60. List price, \$649. Trade discount, 50 and 5 off.
61. List price, \$954. Trade discount, 60 and 5 off.
62. List price, \$472. Trade discount, 20 and 3 off.
63. List price, \$380. Trade discount, 10 and 8 off.
64. List price, \$684. Trade discount, 20 and 1 off.
65. List price, \$998. Trade discount, 10 and 4 off.
66. List price, \$651. Trade discount, 30 and $\frac{1}{2}$ off.
67. List price, \$690. Trade discount, 40 and $\frac{1}{4}$ off.
68. List price, \$200. Trade discount, 20 and 10 off.
69. List price, \$485. Trade discount, 10 and 20 off.
70. List price, \$320. Trade discount, 40 and 20 off.
71. List price, \$252. Trade discount, 10 and 10 off.
72. List price, \$843. Trade discount, 30 and 40 off.

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73. List price, \$500. Trade discount, $2\frac{1}{2}$ and $\frac{1}{8}$ off.
74. List price, \$384. Trade discount, 10 and $2\frac{1}{2}$ off.
75. List price, \$333. Trade discount, 50 and $12\frac{1}{2}$ off.
76. List price, \$480. Trade discount, $33\frac{1}{3}$ and 5 off.
77. Invoiced price, \$1020.45. Discount, 10, 5, and 3 off.
78. Invoiced price, \$2142.45. Discount, 5, $2\frac{1}{2}$, and $\frac{1}{8}$ off.
79. Invoiced price, \$402.18. Discount, 20, 5, and $2\frac{1}{2}$ off.
80. Invoiced price, \$104.80. Discount, 10, $8\frac{1}{3}$, and $\frac{1}{4}$ off.
81. Invoiced price, \$692.45. Discount, 40, 10, and 5 off.
82. Invoiced price, \$804.20. Discount, 50, 30, and 1 off.
83. Invoiced price, \$201.13. Discount, 30, 20, and 10 off.
84. Invoiced price, \$404.50. Discount, 20, 10, and $3\frac{1}{3}$ off.
85. Invoiced price, \$930.00. Discount, $33\frac{1}{3}$, 20, and $2\frac{1}{2}$ off.
86. Invoiced price, \$224.40. Discount, 25, $16\frac{2}{3}$, and $12\frac{1}{2}$ off.
87. The gross amount of a bill of merchandise is \$186.36; what is the net amount, the rates of discount being 30% and 20%?
88. What direct discount is equivalent to a discount of 20% and 10%?
89. What direct discount is equivalent to a discount of $33\frac{1}{3}\%$, 20%, and 1%?
90. What is the difference on a bill of \$425 between a discount of 50% and a discount of 30% and 20%?
91. A book broker buys books at 20% and 10% from the catalogue prices, and sells them at an advance of 10% on catalogue prices. What per cent profit does he make?
92. An agent buys 3 pianos, the list prices of which are \$420, \$630, and \$800. He is allowed 20 and 10 off. He sells the pianos at an advance of 50% on the cost prices. Find his total profit.

93. A retail bookseller buys at a discount of 20, 10, and 5 off, and sells at list prices. What per cent profit does he make?

94. A merchant buys furniture at 20% and 10% from list prices, and sells it at 10% and 5% from list prices. What per cent profit does he make?

95. A sewing machine agent buys \$60 machines at a discount of 30% and 16 $\frac{2}{3}$ %. He sells them at an advance of 5% on the list price. Find his profit on each.

III. INVOICES.

HINTS AND DEFINITIONS.

An **invoice** is a detailed statement of merchandise sold by one dealer to another.

The place and date of sale, and the names of the buyer and seller, should be given.

A few of the terms, characters, and abbreviations made use of in making out invoices, are given below:—

A 1.	First quality.	Inst.	Present month.
c/	Care of.	Prox.	Next month.
Do.	Ditto, the same.	Ult.	Last Month.
Com	Commission.	Mdse.	Merchandise.
Bxs.	Boxes.	Memo.	Memorandum.
Bgs	Bags.	No. or #	Number.
Bbl.	Barrel.	Per.	By, or by the.
Bal.	Balance.	Shipt.	Shipment.
Fol.	Folio or page.	C. O. D.	Collect on delivery.

BUSINESS EXERCISES.

96. Books.—New York, January 3, 1886. S. R. Warner & Co., Toronto, Ont., bought of A. S. Barnes & Co., 12 sets New National Readers at \$1.75; 3 Popular History of the United States at \$5; 5 Monteith's Science Reader at \$1.25; 18 Sill's Lessons in English at 90c.; 14 Comprehensive Geography at 75c.; 24 Practical Arithmetic at 80c.; 18 Steele's Chemistry at \$1.20; 12 Steele's Physiology at \$1.20; 18 Watson's Elocution at 40c. Less 30% and 10%; 36 doz. Copy Books at 65c. per doz. net; 40 doz. Drawing Books at 75c. per doz. net. Packing 75c.

NOTE.—Invoices are very different in detail. No rules for the guidance of students can be given. The peculiar methods of any particular business house can be learned only by actual practice in that house. The exercises which follow are intended for general business practice.

[EXERCISE 96.]

NEW YORK, Jan. 3, 1886.

S. R. Warner & Co.,

Toronto, Ont.,

Bought of A. S. Barnes & Co.

Terms cash.

12	Sets New National Readers .	\$1.75	21	00		
3	Popular History of U. S. . .	5 00	**	**		
5	Monteith's Science Primer .	1.25	*	**		
18	Sill's Lessons in English . .	.90	**	**		
14	Comprehensive Geography .	.75	**	**		
24	Practical Arithmetic80	**	**		
18	Steele's Chemistry	1.20	**	**		
12	Steele's Physiology	1.20	**	**		
18	Watson's Elocution40	*	**		
			***	**		
	Less 30% and 10%		**	**	**	**
36	Doz. Copy Books. Net . .	.65			**	**
40	Doz. Drawing Books. Net .	.75			**	**
	Packing					75
					***	**
	Certified correct.					
	A. S. BARNES & Co.					

NOTE.—When goods are shipped from one country to another the sender of the goods sends a **certified invoice**—an ordinary invoice with the words “certified correct,” and the signature of the seller. Such an invoice is accepted as *correct* by the collectors of customs.

97. Dry Goods.—Chicago, January 5, 1886. Messrs. E. T. Stone & Co., Grand Rapids, Mich., bought of William Cross & Son, 24 pieces Gordon Prints, 48 yds. each, at $5\frac{1}{2}$ c.; 18 pieces Merrimac Prints, 47 yds. each, at $4\frac{1}{2}$ c.; 32 pieces Standard Prints, 45 yds. each, at 4c.; 20 pieces American Prints, 50 yds. each, at 6c. Cooperage \$1.25.

98. Canned Goods.—Wilmington, Del., January 9, 1886. S. W. Clark & Bro., Kansas City, Mo., bought of James Morrow & Son, 5 doz. 3 lb. Peaches at \$2.10; 4 doz. 6 lb. Peaches at \$3.45; 4 doz. 3 lb. Tomatoes at \$1.90; 3 doz. $2\frac{1}{2}$ lb. Apricots at \$3.90. Less 5% for cash. Cooperage 90c.

99. Books.—Philadelphia, Pa., February 3, 1886. Canada Publishing Co., Toronto, Ont., bought of J. B. Lippincott Co., 15 Dickens, People's Edition, 15 vols., at \$22.50; 7 George Eliot, 20 vols., at \$35; 13 Thackeray, Globe Edition, 12 vols., at \$15; 14 Charles Reade, 17 vols., at \$21.25; 36 The "Duchess" Novels at \$1. Less 40%, 10%, and $\frac{1}{2}$ %. Cooperage \$1.20. (A certified invoice necessary).

100. Groceries.—Baltimore, Md., March 12, 1886. James R. Wallace & Co., Syracuse, N.Y., bought of H. Chisholm & Co., 3 bbls. Granulated Sugar at \$7.50; 17 boxes Raisins at \$1.75; 4 boxes Layer Raisins at \$2.15; 15 lbs Spice at 16c.; 24 boxes Currants at \$1.40; 2 bags Rio Coffee at \$27.20; 2 bbls. Syrup at \$18.50; 12 lbs. Nutmegs at 90c. Special discount, 10 and 5 off. Cartage \$1.50.

101. Fruit.—Rochester, N.Y., August 13, 1886. S. R. Riley & Co., Jacksonville, Ill., bought of H. P. Wallace & Son, 273 bbls. Winter Apples at \$1.15; 136 bbls. Fall Apples at \$1.05; 362 bush. Plums at \$2.12 $\frac{1}{2}$; 163 baskets Peaches at 63c.; 428 baskets Pears at 42c. Less 20%. Cartage \$12.85.

102. Flour and Feed.—Montreal, Que., April 15, 1886. Edwin Ball, Sherbrooke, Que., bought of Thompson, Watt & Co., 13 bbls. Best Flour at \$5.30; 14 bbls. No. 2 Flour at \$4.75; 32 bbls. Pork at \$18.90; 942 lbs. Hams at 13c.; 432 bush. Oats at 31c.; 15 cwt. Bran at 55c. Less 33 $\frac{1}{3}$ %, 10%, and 2%.

103. Hardware.—Toronto, Ont., March 13, 1886. Hugh Cleland, Meaford, Ont., bought of Rice Lewis & Son, 200 Carriage Bolts at \$2.25 per C.; 150 Carriage Bolts at \$3.15; 5 doz. R. S. K. Knives at \$2.14; $4\frac{1}{2}$ doz. Pieced Bread Pans at \$2; 15 Eureka Stoves at \$14.90; 13 Royal Coal Stoves at \$18.40; 6 Iron Posts at \$1.30. Less 7% for cash.

104. Furniture.—San Francisco, Cal., May 3, 1886. G. W. Powell & Bro., Denver, Col., bought of Thompson & King, 22 Bedroom Sets at \$32.50; 18 Parlor Sets at \$42.75; 6 Walnut Sideboards at \$18.25; 12 Walnut Dining Tables at \$21.30; 14 Cherry Book Cases at \$13.50; 17 Easy Chairs at \$4.35. Less 40%, $12\frac{1}{2}$ %, and $2\frac{1}{2}$ %.

105. Lumber.—Detroit, Mich., November 18, 1886. The Western Lumber Co., Milwaukee, Wis., bought of Patterson Bros. & Co., 293,500 ft. Pine, first quality, at \$42; 132,600 ft. Pine, third quality, at \$16; 425,250 ft. Hemlock at \$22; 83,750 ft. Basswood at \$26; 48,650 ft. Elm at \$72.50. Less a regular discount of $37\frac{1}{2}$ %, and 5% additional for cash.

IV. COMMISSION.

HINTS AND DEFINITIONS.

Commission is an allowance or compensation to an agent, commission merchant, or factor.

Commission merchants are usually placed in possession of the goods bought or sold.

The business of a **broker** is similar to that of a commission merchant. Brokers do not have possession of the merchandise bought or sold.

The term *broker* is more generally applied to those whose business it is to buy and sell stocks, bonds, notes, etc.

The person for whom the business is transacted is called the **principal**.

The person who sends goods to be sold is called the **consignor** or **shipper**.

The name **consignment** is given to the goods sent.

The person to whom the goods are sent is called the **consignee**.

The **net proceeds** of a consignment is the balance due the *consignor* after charges and expenses have been deducted.

The commission or brokerage for buying or selling merchandise or real estate is usually estimated at a certain per cent of the amount invested or realized.

BUSINESS EXERCISES.

106. An estate dealer sells a house and lot for \$5620 at $2\frac{1}{2}\%$. What is his commission for selling?

107. A salesman receives $2\frac{1}{2}\%$ of his sales. His sales for a certain week amounted to \$943.50. What was his commission for that week?

108. What must be a traveler's sales for one year that he may, at 3% commission, have a yearly income of \$2400?

109. A lawyer collected a note of \$242.50; how much should he pay to the owner of the note, his commission being 8%?

110. My attorney collected 80% of a debt of \$5500, and charged $7\frac{1}{2}\%$ commission. What amount should he pay me?

111. My agent sold my house and lot for \$4850. He bought me a new house and lot for \$3725. His commission for selling was 4%, and for buying 2%. How much cash should I receive?

112. What is the amount of the sales when the brokerage charged is \$64 at $\frac{1}{4}\%$?

113. What is the amount of the sales when the net proceeds are \$2493.16, brokerage $\frac{3}{4}\%$?

114. Sent \$414 to an agent to be invested in prints at 13 cents a yard, after deducting his commission of $2\frac{1}{2}\%$ of the sum sent. How many yards can he purchase?

NOTE.—To be accurate the commission should be reckoned on the actual sum invested, and not on the \$414. In ordinary transactions, however, commission is deducted as above.

115. My agent in St. Paul buys for me 3245 bushels of wheat at \$1.08. What is his commission at $\frac{1}{2}\%$?

116. Sent \$6180 to a commission merchant to invest in flour, his commission being 3% on the amount expended. How many barrels of flour, at \$4.80 per barrel, can he purchase?

117. An estate agent sells 420 acres of land at \$18.50 an acre, and charges $2\frac{1}{4}\%$ commission. What is his commission?

118. A commission merchant sells a consignment of wheat for \$7240. He pays \$42 for freight and storage, and charges a commission of $2\frac{1}{4}\%$. What are the net proceeds?

119. An agent charges $5\frac{1}{4}\%$ commission, and receives \$441 for his services. Find the amount of his sales.

120. A merchant buys, through an agent, 480 yards of carpet at 80 cents per yard, and pays the agent $\frac{3}{4}\%$ commission. The freight amounted to \$1.92. At what price per yard must the carpet be sold to realize a profit of $33\frac{1}{3}\%$?

121. A book agent receives a commission of 25% on the gross amount of his sales, \$1 for each book sold, and a salary of \$120 a year. During a certain year he sold 480 books at \$7 each. What was his income for that year?

122. A country merchant receives a commission of $16\frac{2}{3}\%$ for selling mowing and reaping machines. He sells during a certain season 3 of the former at \$90 each, and 5 of the latter at \$120 each. His expenses connected with the sales were \$17.50. Find his profit.

123. A young man established a newspaper subscription agency. His expenses were \$18.50 a month, and his commission 20%. During 1885 he received 130 subscriptions at \$6 each, 142 at \$4, 360 at \$2, 182 at \$1.50, and 573 at \$1. What was his net income for the year?

124. An agent received \$1269 with which to purchase goods after deducting his commission of $5\frac{3}{4}\%$ of the sum actually invested. Find his commission.

125. A manufacturer sent \$5202 to a leather dealer with which to purchase leather at 2% commission on the sum invested. How much commission should he deduct?

126. A worked B's farm of 320 acres for one year "on shares." A received 25% of the gross receipts for his labor, and the balance was divided equally. Wheat was raised on the entire farm; it yielded 28 bushels to the acre, and was sold at $\$1.12\frac{1}{2}$ per bushel. Find B's share of the profits.

V. TAXES.

HINTS AND DEFINITIONS.

Taxes are sums of money assessed on persons, property, or incomes, to defray the expenses of a country or corporation.

Real estate is fixed property, as lands and houses.

Personal property is movable property, as money, goods, furniture, ships, cattle, stocks, etc.

An **assessor** is an officer appointed to estimate the value of property.

A **capitation** or **poll tax** is a tax assessed, without regard to property, upon the person of every adult male citizen not exempted by law.

A **license** is a written permit to conduct a certain business, and a **license fee** is the sum charged for such permit.

Duties or **customs** are taxes levied by the government on goods imported from foreign countries.

An **ad valorem duty** is a tax levied upon imported goods at a certain per cent of their dutiable value.

Duties are not computed on fractions of a dollar. If the cents are less than 50 they are rejected; if 50 or more the dollars are increased by 1.

A **specific duty** is a tax levied upon imported goods according to their weight or measure, and without reference to their value.

Some goods are subject to both a *specific* and an *ad valorem* duty.

PRACTICAL EXERCISES.

127. The assessed value of a property is \$4760, and the rate of taxation $\frac{1}{8}\%$. Find the tax.

128. The assessed value of a house and lot is \$7500, and the rate of taxation $\frac{1}{4}\%$. Find the tax.

129. My real estate is assessed at \$8500. The rate is three mills on the dollar. What taxes have I to pay if I am allowed 4% for prompt payment?

130. A man's property is assessed at \$7200. What is his tax, the rate being \$8.75 on \$1000?

131. The assessed valuation of a town is \$3,500,000. The money to be raised is \$4,900. What is the rate?

132. What is the tax on 9350 pounds of tobacco at 16 cents?

133. A tax of \$5900 is levied for building a school-house. The assessed valuation of the village is \$2,242,000. What is the tax on a property assessed at \$6750?

134. A teacher pays an income tax of 3 mills on the dollar on a salary of \$1250, and a poll tax of \$2. What is his net income?

135. At what rate must property valued at \$65,000 be assessed to raise \$130?

136. What is the valuation of a piece of property that pays a tax of \$273 at a rate of $3\frac{1}{4}$ mills on the dollar?

137. If a tax of \$140 is assessed upon a cotton mill valued at \$24,000, what is the valuation of a piece of property that pays a tax of \$38.50, at the same rate?

138. What sum must be assessed on a school district to build a school-house at a cost of \$5460, and pay $2\frac{1}{2}\%$ for collection?

139. What sum must be raised in order that \$19,600 shall remain after paying a commission of 2% for collecting the taxes?

140. What is the tax on 9328 gallons of distilled spirits at 70 cents?

141. How much is the semi-annual tax of a national bank whose average circulation is \$335,000 at $\frac{1}{2}\%$, average deposits \$2,346,840 at $\frac{1}{4}\%$, and average capital stock \$800,000 at $\frac{1}{4}\%$.

142. A pedlar pays a license fee of \$12.50 per year. His net income for a certain year is \$875. The tax is equivalent to what rate per cent?

143. What is the duty, at 20%, on 420 boxes of raisins, each containing 40 pounds, and costing 7 cents a pound?

144. A merchant's importation of silks from France was invoiced at 8120 francs. Find the duty in dollars and cents, the rate being 60%.

145. Find the duty on a shipment of books from the United States to Canada, invoiced at \$324.20, at 15%.

146. Woolens valued at £423 12s. 6d., and weighing 724 pounds, were imported from England. What was the duty at 40 cents per pound and 25% ad valorem.

147. Find, in American currency, the duty on a shipment of linens from Ireland, invoiced at £123 8s. 6d., at 35%?

148. What is the duty on 4368 pounds of wool, invoiced at \$1826, when the rate is 7 cents per pound and 8% ad valorem?

149. Goods invoiced at \$450 have become damaged. Find the amount of the duty at $33\frac{1}{3}\%$, the allowance for damages being 25%.

150. At 40% ad valorem, what is the duty—American currency—upon an importation of 300 dozen kid gloves, invoiced at 72 francs per dozen?

151. A Toronto fruit dealer imports 24 boxes of oranges from Florida. Each box contains 250 oranges. They are invoiced at \$2.75 a box. The freight is \$10.15, the duty 15%, the broker's fee 50 cents, and the expense of delivery 75 cents. How much will be gained by selling the oranges at 25 cents per dozen?

VI. REVIEW.

MISCELLANEOUS DRILL EXERCISES.

152. Five per cent of a number is what per cent of $\frac{1}{5}$ of the number?

153. By selling cashmere at \$1.40 per yard I gain $16\frac{2}{3}\%$. What is my gain on a sale amounting to \$32?

154. A merchant's collector deducts his commission of 2% from a bill; the balance is \$1960. What was the bill?

155. A merchant buys a quantity of coffee and sells it again so as to gain 10%. Had he bought it at 10% less and sold it for \$5 less, he would have gained 20%. Find the cost price.

156. A dealer sells a horse at a loss of 4%. Had he sold it for 6 guineas more he would have gained 5%. Find the original cost.

157. A boy buys chestnuts at \$2.50 a bushel and sells them at 5 cents a pint. What per cent does he make?

158. I bought a city lot and immediately sold it for \$1200, thereby gaining 20%. I bought another lot with the \$1200 and sold it at a loss of 20%. Did I gain or lose on the two transactions, and how much?

159. If a merchant marks his goods at 25% above cost, what per cent must he allow a customer in order to make a profit of 10%?

160. A bookseller bought Christmas cards at a discount of 30% and 5%. The clerk, however, in making out the bill deducted 35%. The bookseller's gain on account of the different discount was \$4.50. What should have been the cash price of the cards?

161. I bought 650 yards of silk in Paris at \$5.25 a yard. The charge for freight was \$15.40, and for storage \$5.85. I paid an ad valorem duty of 25%, and sold the goods for \$5716. What was my gain per cent?

162. In the erection of a barn I paid twice as much for lumber as for labor, and twice as much for labor as for stone. Had I paid 6% more for lumber, 8% more for labor, and 2% more for stone, the barn would have cost me \$3710. What was the cost of the barn?

163. A sold a carriage to B and gained $7\frac{1}{2}\%$. B sold it to C for \$141.90 and lost 12%. How much did the carriage cost A?

164. A grocer buys two sorts of tea at 2s. 9d. and 3s. 1d. per pound respectively. He mixes them so as to have 3 pounds of the dearer for 1 pound of the cheaper, and sells the mixture at 4s. per pound. What does he gain per cent?

165. If by selling an article for \$9.50 I lose 5%, for how much should I sell it so as to gain 5%?

166. Two persons commenced business with equal capital. One gained 25%, the other $33\frac{1}{3}\%$. What was their capital if the difference between their gains is \$2720?

167. I send my agent \$2075.70 to invest in sugar, after deducting his commission of $1\frac{3}{4}\%$ of the sum invested. How many pounds at $8\frac{1}{2}$ cents should he forward me?

168. Two boys buy apples at a cent each. One sells them at 3 for 4 cents, and the other at 4 for 5 cents. Compare their gains per cent.

169. A merchant sold two overcoats for equal sums of money. He gained 25% on the one and lost 25% on the other. His loss on the whole transaction was \$2.40. Find the cost of each coat.

170. An implement dealer asked for a reaper 30% more than it cost. He finally took 20% less than his asking price, and gained \$5 on the machine. How much did he ask?

171. The proprietor of a factory proposes to reduce wages $12\frac{1}{2}\%$. His men *strike*, but afterwards submit on condition that their wages remain the same, but that their time, which is $10\frac{1}{2}$ hours a day, be increased. How much should it be increased?

172. I sold two horses and got $6\frac{1}{4}\%$ less for the second than for the first. On the first I gained 20% and on the second I lost 10%. My whole gain was \$15. Find the cost of each horse.

173. What must a merchant ask for boots that cost \$3.60 a pair that he may make a discount of 10% and still gain 25%?

174. A merchant's sales for one week showed an increase of 10% each day on the sales of the previous day. His total sales for the week amounted to \$3857.80 $\frac{1}{2}$. Find his average sales per day.

175. A grocer buys sugar at the rate of 12 pounds for \$1 and sells it at the rate of 10 pounds for \$1. What does he gain per cent?

176. If I sell $\frac{6}{7}$ of an article for what $\frac{3}{4}$ of it cost me, what per cent do I lose?

177. A bookseller's price for certain books is 25% above cost. He allows teachers a discount of 12%. He receives \$14 from a teacher in payment of a bill. What profit did he make?

178. What is the difference on a bill of \$875 between a discount of 40%, and a discount of 30% and 10%?

179. A miller takes 4 quarts as toll for each bushel ground. What per cent does he take for toll?

180. What per cent of $\frac{8}{17}$ is $\frac{2}{83}$?

181. A girl who attended school 68 days during a term was marked 85% for attendance. How many days was she absent?

182. A horse and carriage were sold for \$459, the horse at a gain of 20% and the carriage at a loss of 10%. The horse cost $\frac{2}{3}$ of what the carriage cost. Find the cost of each.

183. A merchant loses 15% by selling goods at 75 cents below cost. For how much should he sell the goods to gain 10%.

184. If copper is mixed with 20% of its weight of nickel, what per cent of the mixture is nickel?

185. A wholesale bookseller allows retailers a discount of $33\frac{1}{3}\%$ on books having fixed prices. What per cent profit do the retailers make?

186. At what price must a bookseller mark a book which costs \$1.20 in order that he may throw off 10% to a student and still make 20%?

187. A wholesale dealer sold at a profit of 25% to a retailer, who compromised with his creditors at 40 cents on the dollar. What per cent did the wholesale dealer lose?

188. A grocer marked a quantity of tea at an advance of 20% on cost. After selling $\frac{2}{3}$ of it he reduced the price 8 cents a pound. His total gain was $77\frac{1}{3}\%$ of what it would have been had he not reduced the price. What did the tea cost per pound?

189. A broker charges $\frac{2}{11}\%$ for investing money, and receives for a certain transaction \$36.80. Find the sum invested.

190. I bought two city lots for \$450 and \$300 respectively. I sold both at the same price, and gained as much per cent on the one as I lost on the other. What did I gain or lose per cent on the transaction?

191. An article is marked to gain 40%, but the seller throws off 10%. A collector is afterwards paid 20% of the debt for collecting it. What per cent is gained?

192. I sold goods at a certain gain per cent. If they had cost me 50% less my gain would have been six times as great. What per cent did I gain?

193. I marked goods to gain 60%, but on account of using an incorrect yard measure I gain only 40%. What is the length of the measure?

194. A dealer sells 20 pounds of tobacco at a profit of 5%, and 30 pounds at a profit of 8%. If he had sold it all at a profit of 6% he would have received 20 cents less. What was the cost per pound?

195. A hatter's expenses during a certain year were $33\frac{1}{3}\%$ of his gross gain on merchandise. His hats were marked 30% above cost. At the beginning of the next year he advanced the price of his goods 10% of the marked price, and during the year cut down his expenses 10%. What did he gain per cent during the second year?

196. A druggist purchases brandy at \$4 a gallon, and adds water so that when he sells it at \$3 a gallon he clears 50%. What per cent of each gallon of the mixture is water?

197. I had a village lot worth \$120; I sold it for \$130; being dissatisfied with my sale, I immediately bought the lot back for \$150. What did I lose per cent by the double transaction?

198. An engine was sold for \$3525, at a loss of 6%. For how much should it have been sold to gain $12\frac{1}{2}\%$.

199. If I compromise with an insolvent creditor for 70 cents on the dollar, and then discount 2% for immediate payment, what is my total loss on a claim of \$6500?

SIXTH DEPARTMENT.

I. INTEREST.

HINTS AND DEFINITIONS.

Interest is the sum charged for the use of money.

Interest is really *the use of money*, or the benefit derived from its use.

The **principal** is the sum for the use of which interest is paid.

The **rate of interest** is the per cent of the principal charged for its use for *one year*.

The **amount** is the sum of the principal and interest.

Legal interest is the interest reckoned at the rate per cent fixed by law.

Usury is interest at a higher than the legal rate.

Simple interest is interest on the principal only, for the full time.

Compound interest is interest on the principal for the full time, and interest on the interest after it becomes due.

EXERCISES FOR MENTAL DRILL.

NOTE.—Do not use pen or pencil.

1. At 15 cents an hour how much should be paid *for the use* of a boat for 12 hours?

2. At \$7.50 a week how much should a farmer pay *for the use* of a reaper 7 weeks?

3. At $3\frac{1}{2}$ cents a day how much should be paid *for the use* of a book 18 days?

4. At \$13.50 a month how much should be paid *for the use* of a bicycle 7 months?

5. At \$6 a year how much should be paid *for the use* of \$100 3 years?

6. A man hires a horse for 3 hours at \$1.50 an hour. What will his *livery hire* amount to?

7. A man rents a house for 13 months at \$12 a month. What will his *rent* amount to?

8. A man borrows \$600 for 1 year at \$7.50 a hundred. How much *interest* will he have to pay?

9. A man borrows \$400 for 3 years at \$6 a hundred a year (6%). How much will he have to pay *for its use*?

10. What is the *interest* of \$500 for 4 years at 6%?

BUSINESS EXERCISES.

DIRECTION.—The principal, the time, and the rate are given; it is required to find the *interest*.

11. Principal, \$200. Time, 2 years. Rate, 6%.
12. Principal, \$340. Time, 3 years. Rate, 7%.
13. Principal, \$420. Time, 4 years. Rate, 4%.
14. Principal, \$720. Time, 5 years. Rate, 3%.
15. Principal, \$844. Time, $1\frac{1}{2}$ years. Rate, 6%.
16. Principal, \$933. Time, $\frac{3}{4}$ year. Rate, $5\frac{1}{3}\%$.
17. Principal, \$225. Time, $\frac{2}{3}$ year. Rate, $4\frac{1}{2}\%$.
18. Principal, \$862. Time, $2\frac{1}{2}$ years. Rate, $3\frac{1}{3}\%$.
19. Principal, \$1000. Time, 3 years. Rate, 7%.
20. Principal, \$1200. Time, 5 years. Rate, 4%.
21. Principal, \$3200. Time, 3 months. Rate, 8%.
22. Principal, \$4850. Time, 9 months. Rate, 6%.
23. Principal, \$2030. Time, 6 months. Rate, $2\frac{1}{2}\%$.
24. Principal, \$1425.30. Time, 3 years. Rate, 6%.
25. Principal, \$1267.50. Time, 6 years. Rate, 7%.
26. Principal, \$2102.30. Time, 1 year. Rate, 3%.
27. Principal, \$4215.50. Time, 1 year 3 months. Rate, 2%.
28. Principal, \$3984.27. Time, 2 years 9 months. Rate, $2\frac{1}{2}\%$.

DIRECTION.—In the exercises which follow consider the time even months.

29. What is the interest of \$240 from June 3, 1886, to August 3, 1887, at 6%?

30. What is the interest of \$425.80 from September 15, 1885, to November 15, 1886, at 2%?

31. What is the interest of \$125.50 from May 15, 1885, to December 15, 1887, at 4%?

32. What is the interest of \$480.40 from June 18, 1884, to August 18, 1884, at 5%?

NOTE.—To find the accurate interest of a sum of money at any rate and for a given number of days, multiply the interest for one year by the number of days and divide the product by 365.

33. Principal, \$420. Rate, 4%. Time, 73 days.

34. Principal, \$563. Rate, 2%. Time, 48 days.

35. Principal, \$360. Rate, 8%. Time, 33 days.

36. Principal, \$840. Rate, 7%. Time, 33 days.

37. Principal, \$1200. Rate, 2%. Time, 146 days.

38. Principal, \$1425.20. Rate, 3%. Time, 219 days.

39. Principal, \$3268.60. Rate, 6%. Time, 132 days.

40. Principal, \$4232.50. Rate, 8%. Time, 100 days.

41. Principal, \$1008.20. Rate, 7%. Time, 203 days.

DIRECTION.—In the exercises which follow reckon the interest for the exact number of days. Count one of the two days named and all the days intervening.

42. Prin., \$1200. Rate, 3%. Time, Jan. 3, 1886, to Mar. 15, 1886.

43. Prin., \$1420. Rate, 4%. Time, Dec. 5, 1886, to Apr. 18, 1887.

44. Prin., \$1730. Rate, 5%. Time, Nov. 9, 1886, to May 27, 1887.

45. Prin., \$2190. Rate, $2\frac{1}{2}\%$. Time, Sept. 4, 1885, to July 19, 1888.

46. Prin., \$4380. Rate, $3\frac{1}{2}\%$. Time, Dec. 3, 1885, to Mar. 21, 1887.

47. Prin., \$3625. Rate, $1\frac{1}{2}\%$. Time, Oct. 2, 1885, to May 17, 1887.

SIXTY-DAY METHOD.

NOTE.—Consider 360 days one year, and 30 days one month; then the interest for 60 days, or two months, at any rate, will be $\frac{1}{2}$ of the interest for one year; and when the rate is 6% the interest for 60 days is 1% or $\frac{1}{100}$ of the principal.

Illustrative Exercises.

1. What is the interest of \$1728 for 80 days at 6%?

\$17	28 = interest for 60 days.	The interest of \$1728 for 60 days at 6%
5	76 = interest for 20 days.	is 1% of \$1728, or \$17.28; and the interest
		for 20 days ($\frac{1}{3}$ of 60) is $\frac{1}{3}$ of \$17.28, or \$5.76.
\$23	04 = interest for 80 days.	Hence for 80 days it will be \$17.28 plus
		\$5.76, or \$23.04.

2. What is the interest of \$1260 for 106 days at 6%?

\$12	60 = interest for 60 days.	Cut off two places to the right.
6	30 = interest for 30 days.	$\frac{1}{2}$ of \$12.60 = \$6.30.
2	10 = interest for 10 days.	$\frac{1}{3}$ of \$6.30 = \$2.10.
1	26 = interest for 6 days.	$\frac{1}{5}$ of \$6.30 = \$1.26.
\$22	26 = interest for 106 days.	

NOTE.—Any number of days can be divided into convenient parts. Thus, to find the interest for 158 days, we could take twice 60 or 120; then 30, which is $\frac{1}{2}$ of 60; then 5, which is $\frac{1}{6}$ of 30; then 3, which is $\frac{1}{10}$ of 30.

3. What is the interest of \$2340 for 3 months 27 days at 7%?

\$23	40 = interest for 60 days or 2 months.	
11	70 = interest for 30 days or 1 month.	
7	80 = interest for 20 days.	$\frac{1}{3}$ of \$23.40 = \$7.80.
2	34 = interest for 6 days.	$\frac{1}{5}$ of \$11.70 = \$2.34.
	39 = interest for 1 day.	$\frac{1}{6}$ of \$2.35 = .39.
\$45	63 = interest for given time at 6%.	
7	61 = interest for given time at 1%.	$\frac{1}{6}$ of \$45.63 = \$7.61.
\$53	25 = interest for given time at 7%.	

NOTE.—Add 1 cent when the fraction is $\frac{1}{2}$ or more.

4. What is the interest of \$3600 for 5 months 19 days at 4%?

\$36 00=interest for 60 days or 2 months.

18 00=interest for 1 month.

90 00=interest for 5 months. $\$18.00 \times 5 = \90.00 .

9 00=interest for 15 days. $15 = \frac{1}{4}$ of 60. $\frac{1}{4}$ of \$36.00=\$9.00.

1 80=interest for 3 days. $3 = \frac{1}{20}$ of 60. $\frac{1}{20}$ of \$9.00=\$1.80.

60=interest for 1 day. $1 = \frac{1}{60}$ of 60. $\frac{1}{60}$ of \$1.80= .60.

\$101 40=interest for given time at 6%.

33 80=interest for given time at 2%. Take $\frac{1}{3}$ of \$101.40 from itself.

\$67 60=interest for given time at 4%.

BUSINESS EXERCISES.

DIRECTION.—Find the interest by the sixty-day method.

48. Principal, \$245. Rate, 6%. Time, 18 days.

49. Principal, \$368. Rate, 6%. Time, 14 days.

50. Principal, \$725. Rate, 6%. Time, 15 days.

51. Principal, \$463. Rate, 6%. Time, 16 days.

52. Principal, \$842. Rate, 6%. Time, 19 days.

53. Principal, \$520. Rate, 6%. Time, 27 days.

54. Principal, \$368. Rate, 6%. Time, 33 days.

55. Principal, \$863. Rate, 6%. Time, 37 days.

56. Principal, \$721. Rate, 7%. Time, 48 days.

57. Principal, \$484. Rate, 7%. Time, 69 days.

58. Principal, \$285. Rate, 7%. Time, 73 days.

59. Principal, \$393. Rate, 5%. Time, 86 days.

60. Principal, \$685. Rate, 5%. Time, 89 days.

61. Principal, \$268. Rate, 4%. Time, 95 days.

62. Principal, \$936. Rate, 8%. Time, 99 days.

63. Principal, \$6000. Rate, 9%. Time, 147 days.
64. Principal, \$4800. Rate, 5%. Time, 201 days.
65. Principal, \$1233.45. Rate, 6%. Time, 127 days.
66. Principal, \$8426.30. Rate, 6%. Time, 132 days.
67. Principal, \$9635.25. Rate, 6%. Time, 143 days.
68. Principal, \$7628.35. Rate, 6%. Time, 214 days.
69. Principal, \$8428.13. Rate, 7%. Time, 121 days.
70. Principal, \$6213.40. Rate, 8%. Time, 129 days.
71. Principal, \$2468.20. Rate, 4%. Time, 184 days.
72. Principal, \$3564.90. Rate, 3%. Time, 163 days.
73. Principal, \$2104.85. Rate, 2%. Time, 319 days.
74. Principal, \$6312.24. Rate, 10%. Time, 119 days.
75. Principal, \$3154.62. Rate, 12%. Time, 133 days.
76. Principal, \$1009.40. Rate, 11%. Time, 148 days.
77. Principal, \$1263.84. Rate, 13%. Time, 101 days.

NOTE—The interest for years and months is found by the sixty-day method by multiplying the interest for 60 days, or two months, by one half the number of months.

78. Principal, \$1240. Time, 9 mo. 27 da. Rate, 3%.
79. Principal, \$3964. Time, 4 mo. 24 da. Rate, $2\frac{1}{4}\%$.
80. Principal, \$6280. Time, 7 mo. 13 da. Rate, $4\frac{1}{2}\%$.
81. Principal, \$3630. Time, 6 mo. 22 da. Rate, $5\frac{1}{2}\%$.
82. Principal, \$1248. Time, 5 mo. 14 da. Rate, $1\frac{1}{2}\%$.
83. Principal, \$1850. Time, 8 mo. 26 da. Rate, $2\frac{1}{2}\%$.
84. Principal, \$4253. Time, 1 yr. 3 mo. 19 da. Rate, 7%.
85. Principal, \$5631. Time, 2 yr. 5 mo. 25 da. Rate, 8%.
86. Principal, \$4280. Time, 3 yr. 7 mo. 18 da. Rate, 10%.
87. Principal, \$3216. Time, 4 yr. 10 mo. 29 da. Rate, $2\frac{1}{2}\%$.

DIRECTION.—Find the exact number of days, and work the exercises by the sixty-day method.

- 88. Prin., \$75.63. Rate, 2%. Time, Apr. 3, 1886, to Jan. 19, 1888.
- 89. Prin., \$42.85. Rate, 3%. Time, May 7, 1886, to Dec. 30, 1887.
- 90. Prin., \$95.43. Rate, 5%. Time, Mar. 8, 1886, to Nov. 18, 1886.
- 91. Prin., \$27.68. Rate, $\frac{1}{2}\%$. Time, July 5, 1885, to Feb. 22, 1887.
- 92. Prin., \$71.15. Rate, 1%. Time, May 6, 1885, to Aug. 21, 1887.
- 93. Prin., \$39.60. Rate, $\frac{1}{4}\%$. Time, July 1, 1885, to Sept. 30, 1887.

NOTE.—In many examples labor can be saved by having the time and principal exchange places. Thus, instead of finding the interest of \$600 for 139 days, find the interest of \$139 for 600 days. The results will be identical.

- 94. Find the interest of \$600 for 139 days at 6%.
- 95. Find the interest of \$120 for 97 days at 7%.
- 96. Find the interest of \$300 for 219 days at 4%.
- 97. Find the interest of \$400 for 185 days at 3%.
- 98. Find the interest of \$180 for 187 days at 2%.
- 99. Find the interest of \$240 for 287 days at 8%.

WRITTEN DRILL EXERCISES.

DIRECTION.—Find the accurate interest except where otherwise directed.

- 100. Find the *amount* of \$425 for 16 months at 7%.
- 101. Find the *amount* of \$1200 for 1 year 9 months at 8%.
- 102. What is a banker's gain in 2 years on \$12,000 deposited at 5% and loaned 22 times at $1\frac{1}{4}\%$ a month?
- 103. A man borrows \$1840 at 5% and loans it immediately at $7\frac{1}{2}\%$. What does he gain in 9 months?
- 104. A man invested \$2400 in a publishing business, and at the end of $2\frac{1}{2}$ years he withdrew \$2940, being investment and profits. What annual rate of interest did his investment pay?

105. Find the *amount* of \$453.60 from September 5, 1886, to June 13, 1887, at 9%. (Sixty-day method.)

106. A man pays \$375 a year rent for a house worth \$5400. Will he gain or lose, and how much in 4 years, if he borrows money at 7% to purchase the house?

107. Bought a piece of property for \$3600 and agreed to pay for it in 8 months with interest at 8%. What amount will be due at the expiration of the time?

108. What must be paid for a loan of \$1800 for $3\frac{1}{2}$ months, at $1\frac{1}{4}\%$ a month?

109. A merchant charges 1% a month on over-due accounts. How much should he collect for an account of \$428.30 which is 7 months over-due?

110. A man invests \$9640 so that it yields him an annual income of \$1156.80. What is the rate of interest?

111. At what rate per annum will any sum double itself in 5 years?

112. What is the rate of interest when \$7500 yields an income of \$62.50 a month?

113. In what time will any sum of money double itself at $6\frac{1}{4}\%$?

114. The half-yearly interest on a mortgage at 7% is \$385. What is the face of the mortgage?

115. A boy is now 17 years old. How much must be invested for him at 7%, simple interest, that when he is 21 he may have \$64,000?

X 116. At what rate will the interest of \$652 for 15 years be \$440.10? $4\frac{1}{2}\%$

X 117. In what time will \$230 amount to \$391 at 7%? 10

X 118. What sum will amount to \$2650 in 8 months at 9%? 250

X 119. The interest of a sum of money for 11 years at $3\frac{1}{2}\%$ is \$77. What is the sum? 200

120. A sum of money amounts in 9 years at 11% to \$597. In how many years will it amount to \$663?

121. The interest of \$1460 for one day is 25 cents. Find the rate per cent per annum?

122. The interest of a sum of money at the end of 15 years was $\frac{2}{3}$ of the sum itself. What rate per cent was charged?

123. At $3\frac{1}{2}\%$ for 8 years what fraction of the principal is $\frac{1}{4}$ of the interest?

124. What sum bearing interest at $4\frac{1}{2}\%$ will yield an annual income of \$1200?

125. A house which cost \$4800 rents for \$24 a month. What is the net rate per annum of interest received on the investment if the average annual expense is \$48?

126. At how much a month should I rent a house which costs me \$3200 that I may receive 6% per annum upon the sum expended?

127. What sum in 10 months at $4\frac{1}{2}\%$ will produce \$3.96 interest?

X 128. What sum in 8 months at 6% will amount to the interest of \$1000 for 13 years at 4%? \$500

129. In what time at simple interest will \$723.16 $\frac{1}{2}$ return $\frac{2}{3}$ of itself in interest at $7\frac{1}{2}\%$?

X 130. A certain sum in 8 months amounts to \$790, and in 19 months to \$845. What is the sum and the rate per cent?

131. What is the value of a house if a rental of \$15 a month is equivalent to $7\frac{1}{2}\%$ on the value?

132. A merchant who clears 15% annually on his investment is forced by poor health to give up his business and to lend his money at $6\frac{1}{2}\%$. His income is thus reduced \$2,550. Find his investment.

X 133. The interest on a certain sum in 9 years is $\frac{2}{3}$ of itself. Find the rate of interest.

EXERCISES IN COMPOUND INTEREST.

Illustrative Exercise.

Find the compound interest of \$1000 for 3 years at 4%.

FIRST METHOD.

\$1000.00	Principal.
40.00	Interest for 1 year.
<hr/>	
\$1040.00	Amount for 1 year, or second principal.
41.60	Interest for 1 year.
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\$1081.60	Amount for 2 years, or third principal.
43.26	Interest for 1 year.
<hr/>	
\$1124.86	Amount for 3 years.
1000.00	Original principal.
<hr/>	
\$124.86	Compound interest for 3 years.

SECOND METHOD.

Amount of \$1 for 1 year at 4% = \$1.04.
 Amount of \$1 for 3 years at 4% = $\$(1.04)^3$.
 $\$(1.04)^3 = \$(1.04 \times 1.04 \times 1.04) = \1.124864 .
 Amount of \$1000 = $\$(1000 \times 1.124864) = \1124.86 .
 Compound interest = $\$1124.86 - \$1000 = \$124.86$.

NOTE.—If the interest is compounded semi-annually the rate per cent is one-half of the yearly rate; if quarterly, one-fourth of the yearly rate.

134. Find the compound interest of \$1000 for 3 years at 6%.
135. Find the compound interest of \$1200 for 2 years at 7%.
136. Find the compound interest of \$2000 for 4 years at 2%.
137. Find the compound interest of \$5000 for 3 years at 5%.
138. Find the compound interest of \$8200 for 2 years at 4%.

NOTE.—To find the compound interest for a period of years and months, find the *amount* for the even years, and add to this sum the interest on it for the fractional part of a year. Subtract the principal and the interest will remain.

139. Find the compound interest of \$750 for 2 years 6 months at 3%. \$784.77

140. Find the compound interest of \$120 for 3 years 3 months at 4%.

141. Find the compound interest of \$840 for 2 years 9 months at 7%.

142. What will \$1000 amount to in 2 years, compounded annually at 4%?

143. What will \$1000 amount to in 2 years, compounded semi-annually at 4%?

144. What will \$2000 amount to in 1 year 6 months, compounded quarterly at 4%?

145. If, at the age of 25 years, a person places \$1000 on interest, compounded annually at 6%, what will be the amount due him when he is 50 years old? ($1.06^{25} = 4.2919$).

146. A father deposits \$100 in a savings bank when his child is 1 year old. How much will this amount to when the child is 21 years old, interest being compounded semi-annually at 4%? ($1.02^{40} = 2.208$).

147. What sum must be placed at 8% compound interest to amount to \$1000 in 5 years?

148. How much should a father invest at 5% compound interest for his son who is 3 years old so that when he comes of age he may have \$10,000? ($1.05^{18} = 2.4066$).

149. Find the difference between the compound and simple interest of \$3000 for 3 years at $7\frac{1}{2}\%$.

150. What is the interest of \$3000 for 12 years at 4% per annum, compounded quarterly? ($1.01^{48} = 1.6122$.)

151. Find the amount of \$10 in 55 years, compounded annually at 10%. ($1.1^{55} = 189.0591$.)

II. COMMERCIAL PAPER.

Commercial paper embraces notes, checks, drafts, bills of exchange, etc.

A **note** is a written promise to pay a specified sum at a certain time.

The person who *promises* is called the **maker**, and the person to whom he promises is called the **payee**.

The **face** of a note is the sum of money promised.

A **negotiable note** is one which is made payable to the bearer, or to the order of the *payee*. A negotiable note can be sold or transferred.

A note is **non-negotiable** when it is payable only to the person or persons named in the note.

A **draft** is a written order by one person on another for the payment of a specified sum. Drafts on foreign countries are called *bills of exchange*.

A **bank draft** is a written order by one bank on another for the payment of a specified sum to a person named therein, or to his order.

Drafts are made payable at sight, on demand, or at a certain time after date or after sight.

A **bank check** is a draft on a banking house, or on a bank, and is usually presented for payment.

Checks are not considered as actual payment until they are paid, but in the course of business are regarded as cash.

Sight drafts, like checks, are presented for payment.

Drafts drawn on time are first presented for **acceptance**.

The person to whom the draft is presented *accepts* it by writing across the face the word "Accepted," with the date, over his signature.

An **indorser** of a note or draft is a person who writes his name on the back of it.

The person who indorses a note or draft, by so doing guarantees its payment.

An **indorsement in blank** is simply the signature of the indorser written across the back of the note or draft.

When indorsed in this way the note or draft is made payable without further indorsement to any person holding it.

A note or draft is **indorsed in full** when the indorser states, over his signature, the person to whose *order* the note or draft is to be paid.

If an indorser does not wish to guarantee the payment of a note or draft he writes "Without recourse" over his name when indorsing.

A **protest** of a negotiable note or draft is a formal statement by a notary public that said note or draft was presented for payment or acceptance and was refused.

A note, when due, must be presented at the place at which it is made payable.

The **day of maturity** is the day on which a note becomes due.

The **days of grace** are the *three days* beyond the specified time usually allowed for payment.

MISCELLANEOUS HINTS.

The words used to make paper negotiable are *order* and *bearer*.

The date means the *day*, *month*, and *year*.

A note may be written on any paper with ink or with pencil, and it will be good.

A note made on Sunday is void.

Notes bear interest only when so stated, except after maturity.

If no time of payment is mentioned in a note it is payable on demand.

The holder of negotiable paper has a claim against every person whose name appeared on it at the time he received it.

"Value received" need not necessarily be inserted in negotiable paper, but it is desirable for the holder.

Notes obtained by fraud cannot be collected.

A note made by a person while intoxicated cannot be collected.

The maker of a note is liable to any person who becomes the owner.

A demand note is valid until presented.

The amount is usually stated in both writing and figures.

When a bank stamps or "certifies" a check it becomes responsible for the amount.

A bank cannot charge payment of a *forged* check to the one whose name was forged to it.

Checks should be presented for payment within a reasonable time.

A draft on two persons who are partners need be presented to but one of them.

A draft does not bind anyone until it is accepted.

Each indorser, by his act in indorsing, certifies to the genuineness of each previous indorsement.

A due bill is an acknowledgment and evidence of debt.

Ignorance of law does not excuse any person.

No contract is good unless there be a consideration.

Usually the name of a firm may be signed by any one of the partners.

When the day of maturity falls on Sunday, or on a holiday, the note is payable on the day following.

If an indorser pays a note he can afterwards negotiate or transfer it.

Releasing a prior indorser releases all who follow.

FORMS OF COMMERCIAL PAPER.

No. 1.

\$400.

Philadelphia, Pa., May 3, 1886.

Due S. L. Clemens, ——— or order, for value received,

Four Hundred ————— Dollars.

R. J. Burdette.

The above is a **due bill** payable in money. It is one of the simplest forms of negotiable papers. If S. L. Clemens wishes to transfer this bill to some one else he writes his name across the back of it. The third party can then hold both Clemens and Burdette responsible. If payment is to be made in goods the words "payable in goods from my store, on demand," or something similar, should be inserted.

No. 2.

\$200.

Rochester, N. Y., *March 15, 1886.*

Two years _____ *after date I promise to pay*
Charles Dudley Warner, _____ *or order,*
Two Hundred _____ *Dollars.*

Value received.

E. P. Roe.

There being no place of payment stated in the above note it is payable at Warner's residence. It will mature 3 days after March 15, 1888, and if not paid then it will draw interest at the legal rate until paid.

No. 3.

\$225.

Toronto, Ont., *January 3, 1886.*

Thirty days _____ *after date I promise to pay*
David Copperfield, _____ *or bearer,*
Two Hundred and Twenty-Five _____ *Dollars,*
at the Imperial Bank. Value received.

Nicholas Nickleby.

The above note is payable at the Imperial Bank 33 days after January 3, or February 5. It is drawn, payable to bearer, and does not need Copperfield's indorsement to make it transferable. If not paid at maturity it will bear interest from that date.

No. 4.

\$320.50.

Boston, Mass., *August 3, 1886.*

Two months after date we jointly and severally promise
to pay Perry Mason & Co., _____ *or order,*
Three Hundred and Twenty _____ $\frac{50}{100}$ *Dollars,*
with interest at 7%. Value received.

*John Greenleaf Whittier.**James Russell Lowell.*

If the above note were written "we jointly promise," it would be a **joint note**, and each of the makers would be responsible for one-half of the amount. Either of the makers of the above note could be sued for the full amount. The note will be due 2 months and 3 days after August 3, or October 6, and draws interest from its date at 7% per annum.

No. 5.

\$120. Nashville, Tenn., *June 12, 1886.*
At sight _____ pay to the order of
Guy Mannering _____
One Hundred and Twenty _____ Dollars,
 value received, and charge to account of
 To *Adam Bede,* | *William Dobbin.*
 Jefferson City, Mo.

This draft is to be paid or cashed when presented. It must be indorsed previously by Guy Mannering.

No. 6.

\$240. Chicago, Ill., *December 9, 1886.*
At thirty days' sight _____ pay to the order of
Will Carleton _____
Two Hundred and Forty _____ Dollars,
 value received, and charge to account of
 To *Walt Whitman,* | *Bret Harte.*
 Cincinnati, Ohio.

This draft must be presented to Walt Whitman, for acceptance, by Will Carleton or his agent. Whitman accepts the draft by writing across the face the word "Accepted," with the date and his signature. When accepted the draft becomes a note, payable 30 days after the date of acceptance. Drafts are sometimes drawn a certain number of days after date.

No. 7.

No. Milwaukee, Wis., *August 5, 1886.*
 THE FIRST NATIONAL BANK
 Pay _____ *Henry Ward Beecher,* _____ or order,
One Hundred _____ Dollars.
 \$100. *T. DeWitt Talmage.*

This check must be indorsed by Beecher before being presented for payment. Banks generally require checks to be indorsed, whether they are payable to order or bearer.

EXERCISES IN TIME.

NOTE.—When the time is given in months reckon even months, and add 3 days of grace. The date of the note and the time are given. It is required to find the date of maturity.

152. Jan. 5.	Time, 3 mo.	162. July 15.	Time, 9 mo.
153. Feb. 3.	Time, 6 mo.	163. May 23.	Time, 8 mo.
154. Dec. 7.	Time, 4 mo.	164. June 27.	Time, 4 mo.
155. Nov. 9.	Time, 2 mo.	165. Apr. 15.	Time, 3 mo.
156. Sept. 3.	Time, 3 mo.	166. Mar. 22.	Time, 2 mo.
157. Oct. 10.	Time, 9 mo.	167. May 20.	Time, 4 mo.
158. Jan. 8.	Time, 5 mo.	168. June 18.	Time, 5 mo.
159. Sept. 7.	Time, 6 mo.	169. July 29.	Time, 10 mo.
160. Nov. 9.	Time, 8 mo.	170. Apr. 30.	Time, 11 mo.
161. Dec. 1.	Time, 5 mo.	171. May 30.	Time, 13 mo.

NOTE.—When the time is given in days the exact days are to be reckoned. Add 3 days of grace. The date of the note and time are given. It is required to find the date of maturity.

172. Sept. 12.	Time, 15 days.	182. July 3.	Time, 60 days.
173. Nov. 23.	Time, 20 days.	183. June 4.	Time, 90 days.
174. Dec. 24.	Time, 30 days.	184. Apr. 9.	Time, 70 days.
175. Jan. 18.	Time, 35 days.	185. May 3.	Time, 65 days.
176. Aug. 19.	Time, 45 days.	186. Mar. 3.	Time, 45 days.
177. Mar. 30.	Time, 60 days.	187. May 9.	Time, 85 days.
178. Oct. 21.	Time, 18 days.	188. June 7.	Time, 47 days.
179. Nov. 13.	Time, 40 days.	189. July 8.	Time, 35 days.
180. Feb. 10.	Time, 10 days.	190. May 9.	Time, 90 days.
181. Mar. 19.	Time, 30 days.	191. June 5.	Time, 20 days.

NOTE.—When the year is not given consider February as having 28 days. The date of the note and the time are given. It is required to find the number of days to maturity.

192. Jan. 23.	Time, 2 mo.	198. July 4.	Time, 10 mo.
193. Feb. 28.	Time, 3 mo.	199. June 5.	Time, 13 mo.
194. Mar. 30.	Time, 4 mo.	200. May 9.	Time, 15 mo.
195. Sept. 18.	Time, 5 mo.	201. Apr. 8.	Time, 18 mo.
196. Oct. 20.	Time, 6 mo.	202. Mar. 5.	Time, 14 mo.
197. Dec. 19.	Time, 3 mo.	203. July 3.	Time, 20 mo.

EXAMINATION QUESTIONS.

1. Explain the terms : *negotiable*, *indorser*, *acceptance*, *protest*.
2. When is a note or draft non-negotiable ?
3. Distinguish between the words *or bearer* and *or order*.
4. How does a sight draft differ from a check ?
5. Is it necessary that a note be *protested* when payment is refused ?
6. If a note falls due on Sunday when is it legally due ?
7. What does a time draft become when it is accepted ?
8. What will E. P. Roe have to do to make Note No. 2 payable to the order of J. T. Trowbridge ?
9. Is note No. 3 transferable without indorsement ?
10. Why are the words "value received" inserted in notes ?
11. Write a check to draw money from your account in the bank.
12. Can paper be transferred after maturity ?
13. What is meant by accommodation paper ?
14. What does an indorser do by his act ?
15. Is the maker of a note bound to pay if demand is not made on the day of maturity ?
16. When is a note due if dated January 31 and made at one month ?

III. BANK DISCOUNT.

HINTS AND DEFINITIONS.

The sum charged by a *bank* for cashing a note or time draft is called **bank discount**.

This **discount** is the simple interest, paid in advance, for the number of days the note or draft has to run.

Wholesale business houses usually sell goods *on time* and take notes from the retailers in payment. These notes are not often for a longer period than three months. Some are placed in the banks for *collection*, others are *discounted*.

When a note is discounted at a bank the *payee indorses it*, making it payable to the bank. Both maker and payee are then responsible to the bank for its payment.

The **proceeds** of a note is the amount on which the discount is reckoned, less the discount.

If the note is drawing interest the discount will be reckoned on and deducted from the amount due at maturity.

Most notes discounted at banks do not draw interest.

The **time** in *bank discount* is always the number of days from the *date of discounting* to the *date of maturity*.

EXERCISES IN TIME.

DIRECTION.—The date of the note, the time it has to run, and the date of discount are given. It is required to find the number of days from the date of discount to the date of maturity.

- | | | | |
|------|-------------------------|--------------|----------------------|
| 204. | Date of note, Jan. 18. | Time, 3 mo. | Discounted Jan. 18. |
| 205. | Date of note, Nov. 21. | Time, 4 mo. | Discounted Nov. 21. |
| 206. | Date of note, Dec. 13. | Time, 5 mo. | Discounted Jan. 13. |
| 207. | Date of note, Mar. 14. | Time, 2 mo. | Discounted Mar. 18. |
| 208. | Date of note, Aug. 22. | Time, 3 mo. | Discounted Sept. 14. |
| 209. | Date of note, May 30. | Time, 30 da. | Discounted June 15. |
| 210. | Date of note, Jan. 28. | Time, 30 da. | Discounted Jan. 31. |
| 211. | Date of note, Nov. 14. | Time, 60 da. | Discounted Nov. 20. |
| 212. | Date of note, July 12. | Time, 45 da. | Discounted July 20. |
| 213. | Date of note, Sept. 19. | Time, 90 da. | Discounted Oct. 10. |

BUSINESS EXERCISES.

Illustrative Exercises.

1. A note of \$250, dated July 7, payable in 60 days, is discounted July 7 at 6%; find the proceeds.

This note is due in 63 days, or September 8.

The accurate interest of \$250 for 63 days at 6% is \$2.59.

The proceeds, then, will be \$250 - \$2.59, or \$247.41.

2. A note of \$730, dated August 3, payable in 3 months, is discounted September 15 at 7%; find the proceeds.

The date of maturity is November 6.

The note then has to run, or is held by the bank, from September 15 to November 6, or 52 days.

The accurate interest of \$730 for 52 days at 7% is \$7.28.

The proceeds, then, will be \$730 - \$7.28, or \$722.72.

DIRECTION.—Find the proceeds of the following notes. Compute the discount on the basis of both 360 and 365 days to the year.

214. Face, \$340. Time, 3 months. Rate of discount, 6%.
Date of note, March 13. Date of discount, March 13.

215. Face, \$400. Time, 4 months. Rate of discount, 6%.
Date of note, May 24. Date of discount, May 24.

216. Face, \$300. Time, 5 months. Rate of discount, 6%.
Date of note, April 13. Date of discount, April 13.

217. Face, \$420. Time, 2 months. Rate of discount, 8%.
Date of note, June 3. Date of discount, June 3.

218. Face, \$1000. Time, 4 months. Rate of discount, 7%.
Date of note, July 24. Date of discount, August 3.

219. Face, \$1200. Time, 3 months. Rate of discount, 5%.
Date of note, August 15. Date of discount, August 30.

220. Face, \$2410. Time, 3 months. Rate of discount, 9%.
Date of note, Sept. 14. Date of discount, October 3.

221. Face, \$390. Time 90 days. Rate of discount, 10%.
Date of note, October 14. Date of discount, Nov. 4.
222. Face, \$4000. Time, 60 days. Rate of discount, 12%.
Date of note, July 3. Date of discount, August 1.
223. Face, \$2500. Time, 90 days. Rate of discount, 9%.
Date of note, June 3. Date of discount, August 13.
224. Face, \$500. Time, 45 days. Rate of discount, 6%.
Date of note, May 16. Date of discount, May 16.
This note bears interest at 7%.
225. Face, \$2400. Time, 120 days. Rate of discount, 8%.
Date of note, August 13. Date of discount, August 29.
This note bears interest at 5%.
226. Face, \$385.62. Time, 113 days. Rate of discount 10%.
Date of note, June 14. Date of discount, August 3.
This note bears interest at $7\frac{1}{2}\%$.

IV. PARTIAL PAYMENTS.

HINTS AND DEFINITIONS.

A **partial payment** is a payment of only a part of a debt.

When a partial payment of a note is made it is **indorsed**, or written on the back of the note.

An **indorsement** states the date and amount of the payment.

Special **receipts** are sometimes given for such payments.

To compute the interest on a note, when partial payments have been made, proceed as follows:—

1. *Compute the interest to the time of the first payment.*
2. *Subtract the first payment from the sum of the interest and principal.*
3. *Treat the remainder as a new principal.*
4. *Proceed in the same manner with the remaining payments until the date of settlement.*
5. *Do not subtract any payment that does not equal or exceed the interest due. Add such payments to the payment following.*

BUSINESS EXERCISES.

DIRECTION.—Compute interest by the sixty-day method.

- 227. Note.**—Date, June 15, 1886. Prin., \$300. Time, 3 years.
Payments.—June 15, 1887, \$120 ; June 15, 1888, \$90.
How much is due at maturity (June 18, 1889)? *Rate, 6%.*
- 228. Note.**—Date, August 3, 1885. Prin., \$400. Time, 2 years.
Payments.—Nov. 3, 1885, \$100 ; Feb. 3, 1886, \$150.
How much is due at maturity ? *Rate, 6%.*
- 229. Note.**—Date, July 4, 1885. Prin., \$600. Time, 90 days.
Payments.—Aug. 15, 1885, \$150 ; Sept. 3, 1885, \$200.
How much is due at maturity ? *Rate, 8%.*
- 230. Note.**—Date, May 3, 1886. Prin., \$450. Time, 3 months.
Payments.—June 14, 1886, \$100 ; July 12, 1886, \$210.
How much is due at maturity ? *Rate, 4%.*
- 231. Note** —Date, Mar. 15, 1886. Prin., \$1000. Time, 120 days.
Payments.—April 16, 1886, \$400 ; May 3, 1886, \$200.
How much is due at maturity ? *Rate, 10%.*
- 232. Note.**—Date, Sept. 27, 1886. Prin., \$1200. Time, 8 months.
Payments.—Oct. 14, 1886, \$640 ; Jan. 3, 1886, \$220.
How much is due at maturity ? *Rate, 6%.*
- 233. Note.**—Date, Nov. 27, 1886. Prin., \$2540. Time, 60 days.
Payments.—Dec. 13, 1886, \$1140 ; Jan. 15, 1886, \$360.
How much is due at maturity ? *Rate, 6%.*
- 234. Note.**—Date, Mar. 15, 1886. Prin., \$390. Time, 6 months.
Payments.—April 5, 1886, \$120 ; June 21, 1886, \$100.
How much is due at maturity ? *Rate, 7%.*
- 235. Note.**—Date, March 3, 1885. Prin., \$1000. Time, 3 years.
Payments.—March 3, 1886, \$100 ; Sept. 3, 1887, \$300.
How much is due at maturity ? *Rate, 12%.*
- 236. Note.**—Date, April 22, 1885. Prin., \$1200. Time, 5 mos.
Payments.—May 3, 1885, \$125 ; Aug. 7, 1885, \$25.
How much is due at maturity ? *Rate, 9%.*

V. REVIEW.

EXERCISES IN TRUE DISCOUNT.

NOTE.—The **present worth** of a debt due at some future time is its value now. In business, the *present worth* is the principal less the interest. The *true present worth*, however, is such a sum that, if placed at interest now, would amount to the face of the debt in the given time. The difference between the *true present worth* and the principal is termed the **true discount**. The *true discount* is the interest on the *true present worth*, while *bank discount* is the interest on the face of the debt. To find the *true present worth*, divide the face of the debt by the amount of \$1 for the given time at the given rate. If the interest = $\frac{a}{b}$ of the *principal*, then the *true discount* = $\frac{a}{a+b}$ of the principal. The problems given below are of no value whatever except as mathematical exercises.

237. Find the true present worth of a debt of \$3360 due in 2 years at 6%. \$ 300

238. Find the true discount of a debt of \$4840 due in 3 years at 7%. 400

239. Which is the better, to buy flour at \$8 per barrel on 6 months credit or at \$7.50 cash, money being worth 6%?

240. Find the difference between the true and the bank discount of \$367.50 due in 3 years at $7\frac{1}{2}\%$.

241. The interest of a certain sum is $\frac{1}{5}$ of that sum. The true discount is \$12. What is the sum? \$ 72

242. Find the true discount of \$4200, the interest for the given time being \$60.

243. The true discount of a certain sum is \$70. What is the interest?

244. If the true discount for 1 year is \$5, and the principal is \$60, find the rate per cent. 9 $\frac{1}{11}$

245. If the true discount for 1 year is $\frac{2}{3}$ of the interest, what is the rate per cent?

246. The interest on a sum of money for a certain time is \$300, and the true discount is \$240. Find the sum of money. \$ 1200

247. The interest is $\frac{2}{5}$ of the principal, and the difference between the interest and principal is \$120. Find the true present worth. 140

248. The interest is $\frac{1}{5}$ of the principal. The difference between the interest and principal is \$120. Find the true present worth. 120

249. The sum of the interest, amount, true present worth, and true discount of a certain principal is \$1250. Find the amount.

MISCELLANEOUS DRILL EXERCISES.

DIRECTION.—Compute interest on a basis of 365 days.

250. In how many years will \$1111.10 double itself at 10% simple interest?

251. The interest on a sum of money in 5 years is $\frac{5}{8}$ of the sum. What is the rate per cent?

252. In $33\frac{1}{3}$ years the simple interest of a certain sum of money is double the true discount for the same time. What is the rate of interest?

253. I buy a horse, and sell him at a profit of \$49, and find that I make as much per cent as the horse cost me. How much did the horse cost?

X 254. What sum must be lent at 8% to produce a yearly income of \$4650? \$ 58125

X 255. At what rate must \$650 be lent to produce a yearly income of \$32.50? 5%

256. The proceeds of a note of \$350, which had 3 months to run, discounted at a bank at 6%, were invested in wool at 35 cents a pound. How many pounds were bought?

257. What principal loaned for 48 days at 6% will amount to \$3588.48? (Sixty-day method.)

X 258. What sum will in 5 years at 5% simple interest amount to \$1000? \$ 800

259. A and B invested \$500 each for 3 years at 5 per cent—A's at simple interest and B's at compound interest. Find the difference in the amount of interest they respectively receive.

260. A grocer gives 11 pounds of sugar for \$1 if cash is paid, and 10 pounds on one year's credit. What is his rate of discount?

261. An army lost 15% by disease, and 13% of the remainder by battle. There are 29,580 men left. How many were there at first?

262. If eggs are bought at 10 cents a dozen and sold at $1\frac{1}{2}$ cents each, how much is gained per cent?

263. If I buy at 60 cents a score, at how much a dozen must I sell to gain 40%?

264. The interest on a certain sum for 9 months at 5% is \$150 less than the interest on the same sum for 15 months at 4%. Find the sum.

265. The amount of a certain sum at simple interest for 3 years is \$558; for $4\frac{1}{2}$ years it amounts to \$612. Find the rate per cent and the sum. *\$ 450 8%.*

266. I borrow \$540 at simple interest for 5 years. At the end of each year the rate is raised 1%. At the end of the time the total interest is \$189. What is the rate for the first year?

267. How much water must be added to 80 gallons of wine 80% strong to make it 50% strong?

268. A sum of money has doubled itself in 16 years at simple interest. What is the rate per cent?

269. I desire to raise \$994.50 by discounting 30-day notes at 6%. Find the face value of the notes. (Sixty-day method. Add 3 days grace).

270. A man failed to pay his tax when due December 1, 1885, and was obliged to settle it April 1, 1886, with $2\frac{1}{2}$ % a month and \$2.50 costs added. He paid \$29.45. What was his tax?

271. For how many years must \$125 be drawing interest at 4% to amount to \$200? *40 yrs*

272. Find the simple interest of \$840 for 2 years 7 months 24 days at 8%. (Sixty-day method).

273. A retired merchant has an income of \$25 a day, his property being invested at 6%. What is he worth?

274. Show that the difference between the interest and the true discount of the same sum is the interest of the discount.

275. If the true present worth of \$838 due in 19 months is \$800, what is the rate per cent?

276. By lending a sum of money at 4%, and another sum at 5%, the total interest is \$68. If the rates are interchanged the interest is \$67. Find the sum lent at each rate.

277. At what rate per cent will a principal double itself, at simple interest, in 25 years?

278. The interest of a certain sum is $\frac{1}{4}$ of the principal. The amount is \$640. Find the principal. *\$560*

279. At what rate per cent, simple interest, will a given sum become four times itself in 20 years?

280. A tradesman marks his goods with two prices, one for ready money and the other for a credit of 6 months. What fraction of the credit prices should the cost prices be, allowing 5% simple interest?

281. What yearly rate is equivalent to 8% compounded half-yearly? What rate compounded quarterly is equivalent to a yearly rate of $10\frac{1}{3}\%$?

282. If a woman buys eggs at 9d. a dozen, how many ought she to sell for 11 shillings to gain 10%?

283. I allow my broker $1\frac{7}{8}\%$. How much do I owe him for selling goods to the amount of £565?

284. In how many years will a man, paying interest at 7% on a debt for land, pay the face of the debt in interest?

285. A merchant sends \$10,246.50 to his agent in Chicago to invest in flour, after deducting his commission of $3\frac{1}{2}\%$ of the sum invested. How many barrels of flour can he buy at \$5.50 per barrel?

286. A grocer buys sugar at 6 cents per pound. Allowing $12\frac{1}{2}\%$ of his sales for bad debts, at what price must he sell it to gain $16\frac{2}{3}\%$?

287. I bought an article and sold it so as to gain 10%. If it had cost 20% less and I had sold it for \$1 less I would have gained 25%. Find the cost price of the article.

MISCELLANEOUS BUSINESS EXERCISES.

DIRECTION.—Compute interest and discount by the sixty-day method.

Transaction.—Toronto, August 3, 1886. F. M. Knowles gives T. Gibson an order on C. Fraser & Co. for \$25, to be paid in goods from his store.

288. Write the order.

289. Gibson gives Knowles a receipt. Write it.

Transaction.—New York, July 5th, 1885. S. S. Packard borrows \$450 from D. T. Ames, and gives his note at ninety days in payment.

290. Write this note. Make it payable to bearer.

291. When will it be due?

292. If interest were charged at 6%, how much would be due at maturity?

Transaction.—New York, July 12, 1885. D. T. Ames has Packard's note discounted at the First National Bank at 7%, and receives cash in return.

293. Indorse the note before discounting it.

294. How much cash should Ames receive?

Transaction.—Chicago, September 4, 1886. Richard Lees buys goods to the amount of \$35.80 from D. E. Lantz & Co., and gives his check on the Second National Bank in payment.

295. Write this check. Make it payable to order.

296. Indorse the check, making it payable to J. Tait's order.

Transaction.—St. Louis, November 15, 1886. W. A. Beer borrows \$337 from E. P. Rowell, and gives his note at three months in payment. Interest 7%.

297. Write this note. Make it payable to order.

298. When will it be due?

299. What amount will be due at maturity?

Transaction.—St. Louis, December 3, 1886. E. P. Rowell has Beer's note discounted at the First National Bank at 8% and receives cash in return.

300. Indorse the note before discounting it. •

301. How much cash should Rowell receive?

Transaction.—Baltimore, March 3, 1886. S. E. Grover buys of S. G. Pryor 320 barrels of flour at \$5.20, and gives in payment cash \$1000; balance on account.

302. Make out S. E. Grover's bill. Receipt it.

Transaction.—Baltimore, April 3, 1886. S. G. Pryor draws a draft at 30 days sight on S. E. Grover, Portland, for the balance of his account. The draft is in favor of E. J. Garrison. Troy.

303. Write the draft.

304. Accept it for S. E. Grover. Date, April 5.

Transaction.—Troy, April 8, 1886. E. J. Garrison has the draft discounted in the Trader's Bank at 10% and receives cash in return.

305. Indorse the draft for E. J. Garrison.

306. How much cash should he receive?

SEVENTH DEPARTMENT.

I. STOCKS AND BONDS.

HINTS AND DEFINITIONS.

A **corporation** consists of several persons who are authorized by law to transact business as a single individual.

A **share** is one of the equal parts into which the *capital stock* of a corporation is divided.

The capital stock of a company is divided into shares usually of \$100 each.

The **par value** of a share is the value which is specified upon the face of the **certificate** representing the share.

The **market value** of a share is the sum for which it can be sold.

Stock is said to be at a **discount** when it is below its par value, and at a **premium** when it is above its par value.

That part of the **net earnings** which is divided among the stockholders is called a **dividend**.

Dividends are declared yearly, half-yearly, or quarterly, at a certain rate per cent of the par value of the stock.

A **preferred stock** is one on which a stated per cent is payable annually, out of the net earnings, before any dividend can be declared out of the common stock.

A **bond** is an obligation of a corporation or government to pay a certain sum of money at a certain time, with a fixed rate of interest payable at regular intervals.

A **coupon bond** is one with certificates attached, representing the different instalments of interest. These coupons are cut off and collected from time to time as the interest becomes due.

Consols are English Government securities.

A **margin** is a deposit made with a broker by a person who wishes to buy or sell stock for speculation, to enable the broker to carry the stock and protect himself against loss.

BUSINESS EXERCISES.

1. How much stock will \$7200 buy at 80?
2. How much stock will \$16,800 buy at 75?
3. How much stock will \$23,750 buy at $118\frac{3}{4}$?

4. How many shares will \$2767.50 buy at $92\frac{1}{4}$?
5. What is the market value of 210 shares at 95?
6. What is the market value of 322 shares at $88\frac{1}{2}$?
7. What is the market value of \$4200 stock at $78\frac{1}{2}$?
8. The par value of stock is \$6000. Find a 4% dividend.
9. The par value of stock is \$7200. Find a $3\frac{1}{2}$ % dividend.
10. The par value of stock is \$9600. Find a 6% dividend.
11. What is the market value of \$7200 stock at a premium of $7\frac{1}{2}$ %?
12. What amount of stock must be sold at $82\frac{1}{2}$ to produce \$3300?
13. If stock is quoted at $92\frac{1}{4}$, what is the market value of 150 shares?
14. What is the market value of \$14,400 stock at a discount of $6\frac{1}{8}$ %?
15. What per cent is realized by investing in stock at 120 paying 6% dividend?
16. What sum must be invested at 90 to produce an income of \$720 if the rate of dividend is 8%?
17. What income is derived from investing \$6545 in stock at $93\frac{1}{2}$ paying a quarterly dividend of 2%?
18. How many shares of New York Central Railway stock can be bought for \$4125 at $82\frac{3}{8}$, brokerage $\frac{1}{8}$ %?
19. What income is derived from investing \$2345 in stock at $117\frac{1}{4}$, paying a semi-annual dividend of $3\frac{1}{2}$ %?
20. At what rate should stock paying annual dividends of 12% be bought to realize $7\frac{1}{2}$ % on the investment?
21. How many shares of railroad stock at $15\frac{5}{8}$ % premium can be bought with \$8111.25, allowing $\frac{1}{4}$ % for brokerage?
22. A quarterly dividend of $2\frac{1}{2}$ % was declared by a manufacturing company. What was the income from 221 shares?

23. A man bought 240 shares of railway stock at $3\frac{3}{8}\%$ discount, and sold the same at $1\frac{7}{8}\%$ premium. Find his net profit?

24. If a quarterly dividend of $2\frac{1}{2}\%$ is received on stock bought at 84, what is the rate of annual income on the investment?

25. A man sold, through a broker, 144 shares of railroad stock at $2\frac{1}{2}\%$ discount, paying $\frac{1}{8}\%$ brokerage. What did he receive?

26. A bank with a capital of \$500,000 declares a dividend of 7%. How much will a stockholder receive who owns 27 shares?

27. A railway company whose capital stock is \$3,225,000 declares a dividend of $4\frac{1}{2}\%$. What is the amount of the dividend?

28. A speculator sold, through a broker, 96 shares of telegraph stock at $5\frac{1}{8}\%$ premium, paying $\frac{1}{8}\%$ brokerage. How much did he receive?

29. At what discount must stock paying a half-yearly dividend of $4\frac{1}{2}\%$ be purchased to enable the buyer to realize 10% on his investment?

30. Which is the better investment: stock paying a regular annual dividend of 6% and bought at 90, or stock paying 8% dividends and bought at 120?

31. A speculator paid \$17,920 for 224 shares of stock, and realized 5% on his investment when the annual dividends were paid. What was the rate per cent of dividend?

32. How much should I pay for 40 shares of railway stock at $3\frac{1}{2}\%$ discount, the broker's charge being $\frac{1}{8}\%$?

33. A gentleman wishes to invest in U. S. bonds at $4\frac{1}{2}\%$ selling at 102 so as to provide a permanent annual income of \$1620 for his invalid son. How much should he invest?

34. If I buy a 6% town bond at 112, what is my rate of income?

35. What premium may I pay for Ninth National Bank stock which declares a dividend of 10% so as to realize $7\frac{1}{2}\%$ on my investment?

II. EXCHANGE.

HINTS AND DEFINITIONS.

The system by which merchants in distant places discharge their debts to each other without the transmission of money is called **exchange**.

The business of exchange is usually conducted through the medium of banks.

A **draft**, or **bill of exchange**, is an order written by one person or bank directing a second person or bank to pay a specified sum to a third person.

Bills of exchange are negotiable or non-negotiable upon the same conditions, and are subject to the same indorsements, as notes.

The **face** or **par** of a bill of exchange is the sum expressed therein. It is the original obligation exclusive of interest, premium, discount, etc.

"When Chicago owes New York the same amount that New York owes Chicago, exchange will be at **par**; that is, drafts will sell at their face value. When Chicago owes New York more than New York owes Chicago, drafts on New York will sell at a **premium**; there will be more buyers of exchange than sellers, and drafts will sell for more than their face value. When Chicago owes New York less than New York owes Chicago, the demand in Chicago for draft on New York will be less than the supply, and drafts will sell for less than their face value, or at a **discount**."

Exchange on **England** is usually quoted by giving the value of £1 in dollars and cents.

The intrinsic par value of £1 is \$4.8665.

BUSINESS EXERCISES.

36. How much exchange on London at $4.81\frac{3}{4}$ will \$821.99 buy?

37. Find the cost of a bill of exchange on London for £320 at $4.81\frac{3}{4}$.

38. Find the cost of a bill of exchange on Liverpool for £420 10s. at $4.87\frac{1}{4}$.

39. Find the cost in St. Louis of a draft on St. Paul for \$4700 at $\frac{1}{4}\%$ discount.

40. Find the cost in New Orleans of a draft on Chicago for \$9600 at $\frac{1}{4}\%$ premium.

41. What is the value in Mobile of a draft on New York for \$4000 at $\frac{3}{8}\%$ premium?

42. The cost of a \$720 draft on Rochester was \$722.70. What was the rate of exchange?

43. What is the value of a 30-day draft on Boston for \$4200 at $\frac{1}{8}\%$ discount and interest at 6%?

44. What is the value of a 30-day draft on Philadelphia for \$8000 at $\frac{3}{8}\%$ discount and interest 6%.

45. What are the proceeds of a draft of £840 10s. 6d. sold through a broker at $4.82\frac{5}{8}$, brokerage $\frac{1}{8}\%$?

46. The face of a draft is \$9460, and the rate of exchange $\frac{3}{8}\%$ discount. What is the value of the draft?

47. What is the value of a 60-day (63 days) draft on Chicago for \$5090 at $\frac{1}{4}\%$ premium and interest 6%?

NOTE.—Subtract the interest and add the exchange.

48. How large a 90-day draft must I draw so that when sold it will produce \$1000; exchange $\frac{1}{8}\%$, discount and interest 6%?

49. A firm in Cincinnati bought a 60-day draft on Boston for \$4800 at $\frac{5}{8}\%$ discount; rate of interest 6%. What was the cost of the draft?

50. A commission merchant in Montreal sells 13,470 pounds of wool at $24\frac{1}{2}$ cents a pound. If his commission is 4% and exchange $\frac{1}{8}\%$ premium, how large a draft can he buy to send to the consignor in Toronto?

51. What is the cost of a draft on New York for \$800, the course of exchange being $100\frac{3}{4}$?

52. What is the face of a draft on New York that can be purchased for \$1234.37 $\frac{1}{2}$, the course of exchange being $98\frac{3}{4}$?

53. A commission merchant sold a consignment of peaches for \$640, and after taking out his commission of 5% bought a draft on Wilmington at $\frac{3}{4}\%$ discount. What was the face of the draft?

54. A sight draft on Pittsburg was bought for \$1771, exchange being at a premium of $\frac{5}{8}\%$. Find the face of the draft.

55. What must be the face of a draft at $2\frac{1}{2}\%$ discount to cost \$2145?

56. What is the value of a 60-day draft on San Francisco for \$5000 at $\frac{1}{8}\%$ premium and interest at 7%?

III. INSURANCE.

HINTS AND DEFINITIONS.

Insurance is indemnity secured against possible loss or damage.

The **policy** is the contract or agreement between the insurer and insured.

The **premium** is the sum paid for insurance, and is usually a certain percentage of the amount insured.

The premium **rates** depend upon the nature of the risk and the length of time for which the policy is issued.

Fire insurance companies do not usually insure property for its full value.

BUSINESS EXERCISES.

57. What will it cost to insure a house for \$3600 at $2\frac{1}{2}\%$?
58. What will it cost to insure a barn for \$500 for 5 years at 3% ?
59. Find the cost of insuring a cargo of goods for \$12,000 at $\frac{7}{8}\%$.
60. What will it cost to insure a mill worth \$18,000 for $\frac{2}{3}$ of its value at $1\frac{3}{4}\%$?
61. A company charges \$60.75 for insuring a house for \$2700. What was the rate of insurance?
62. I paid \$1443.75 for insuring 5000 barrels of flour worth \$5.25 a barrel. What was the rate of insurance?
63. What is the premium for insuring a cargo of 4840 bushels of wheat, valued at \$1.20 a bushel, at $1\frac{1}{8}\%$ on $\frac{2}{3}$ of its value?
64. A man paid \$350 for insuring his dwelling at $\frac{7}{8}\%$ for one year. If destroyed by fire how much is he entitled to receive?
65. A building was insured for \$3000 in one company at $1\frac{1}{4}\%$, and for \$4000 in another company at $1\frac{1}{2}\%$. What was the total premium paid?
66. A company insured a business block for \$90,000 at $\frac{1}{4}\%$. At the end of 5 years the block was destroyed by fire. If $\frac{3}{4}$ of the claim was paid how much did the company lose? (Interest not considered.)

IV. BANKRUPTCY.

HINTS AND DEFINITIONS.

A **resource** or **asset** is any kind of property having a financial value belonging to a concern or business.

A **liability** is a debt owing by a concern.

The **net worth** of a concern is the excess of its resources over its liabilities.

The **net insolvency** of a concern is the excess of its outside liabilities over its resources.

If a concern is unable to pay its debts it is said to be **bankrupt**, or **insolvent**.

The **assets** of a bankrupt include debts due to him by others.

The **creditors** are the persons to whom the bankrupt is indebted.

BUSINESS EXERCISES.

67. A man's assets are \$3000 and his liabilities \$4000. How much can he pay on the dollar?

68. A man's resources are \$4800 and his liabilities \$7200. How much can he pay on the dollar?

69. A bankrupt pays $37\frac{1}{2}$ cents on the dollar. How much will be lost by a creditor whose bill is \$750?

70. A bankrupt pays 42 cents on the dollar. How much will be lost by a creditor whose bill is \$378?

71. A merchant bought a bankrupt stock at 45 cents on the dollar and sold it 10% below the original price. How much per cent did he gain?

72. How much should a bankrupt pay on the dollar if his liabilities are \$15,000 and his assets \$4000?

73. A jobber bought a bankrupt stock at $34\frac{1}{2}$ cents on the dollar and retailed it at 10% above the original wholesale price. His expenses were 5% of the total sum of money received. Find his gain per cent on the goods.

74. A bankrupt's liabilities are three times as great as his assets. A certain creditor sold his goods at 25% above cost. What per cent does he lose?

V. PARTNERSHIP.

HINTS AND DEFINITIONS.

A **partnership** is an association of two or more persons for the purpose of conducting business.

Such an association is called a *firm*, a *house*, or a *company*.

Each individual of the association is called a **partner**.

An **active partner** is one who is publicly known as such.

A **silent partner** is one who, though actually a partner, is not publicly known.

A **special partner** is one who furnishes a certain portion of the capital of the firm, and holds himself liable for that amount only.

A **nominal partner** is one who has no real interest in the business, but who assumes the responsibility of a partner by lending his name and credit.

The **investment** of a firm is the aggregate of the money or property jointly contributed by the partners.

The **net gain** is the excess of the total gains of a firm over its total losses within a certain period.

BUSINESS EXERCISES.

75. A and B form a partnership to carry on a dry goods business. A invests \$2000 and B invests \$5000. Divide a gain of \$2065 in proportion to the investments.

76. A, B, and C gain \$6335 in a speculation. A invested \$2400, B \$3200, and C \$1400. How much of the gain should each partner receive?

77. X, Y, and Z rent a pasture for 5 months at \$16.20 a month. X puts in 3 horses for 3 months, Y puts in 5 horses for 2 months, and Z puts in 7 horses for 5 months. How much of the rent should each pay?

78. A starts in business at the beginning of the year with a capital of \$3600. At the end of 6 months he takes in B as a partner with \$4200 capital. They gain \$3420 during the year. How much of the gain should B receive?

79. A and B agreed to do a piece of work for \$130. A worked 7 days of 5 hours each, and B worked 5 days of 6 hours each. How much should each be paid?

80. Two carpenters take a contract of building a house for \$2751. The one works steadily for 32 days of 10 hours each; the other works 24 days of 8 hours each. They pay \$1215 for material. How much of the profit should each receive?

81. Two teachers, A and B, establish a private school. They are to divide the profits equally. During the year A receives cash \$520, and pays expenses in cash \$127; B receives cash \$470, and pays expenses in cash \$92. How much money should A pay B to make an equal division of the gain?

82. Two men, M and N, are associated in trade. M receives \$25 a month and 10% of sales for managing the business. The net gain is then divided equally. Their sales for a certain year amount to \$9320, and their books show a gain of \$4220 before M's special interest is paid. Find N's share of the net gain.

83. Drs. P and Q are associated in professional work. They each receive and pay cash. On January 1, 1885, their bank book showed a balance of \$420. During the year Dr. P received cash \$3420, paid office expenses \$142, and deposited \$1340. During the same time Dr. Q received cash \$4840, paid office expenses \$94, and deposited \$2365. They issued *firm* checks amounting during the year to \$480. Adjust the bank balance, leaving \$500 on deposit.

84. A, B, and C are partners. A puts into the concern \$6000, but withdraws half of it at the end of 6 months; B puts in \$4000, and adds \$1000 to it at the end of 4 months; C puts in \$5000 for the whole year. The gain during the year is \$5100. What is each one's share?

85. Three contractors agree to build a bridge for \$14,188. The first has 42 men at work for 18 days and 20 men for 32 days. The second has 30 men for 10 days and 50 men for 35 days. The third has 24 men for 50 days. The first receives \$250 for superintending the work. How much is each contractor entitled to?

86. A and B hire a car for \$84 for the purpose of shipping stock. A puts in 2 horses and 6 oxen, and B puts in 5 horses and 4 oxen. They agree that the cost of a horse and an ox shall be as 3 is to 2. Divide the cost.

VI. SQUARE ROOT.

HINTS AND DEFINITIONS.

When a number is multiplied by itself the result is called the **square** of the number.

The **square root** of a given number multiplied by itself will produce the given number.

The *square root* is usually indicated by the sign $\sqrt{}$.

The square root of a small number can be found either by **inspection** or by **factoring**.

Illustrative Exercise.

Find the square root of 7056.

The prime factors of 7056 are 2, 2, 2, 2, 3, 3, 7, and 7.

These can be divided into two groups of 2, 2, 3, and 7 each.

Then $2 \times 2 \times 3 \times 7 = 84 =$ the square root of 7056.

WRITTEN DRILL EXERCISES.

DIRECTION.—Find the square root.

87. 196.	92. 1024.	97. 17956.
88. 225.	93. 5625.	98. 11664.
89. 529.	94. 4096.	99. 17424.
90. 361.	95. 5184.	100. 21025.
91. 729.	96. 6561.	101. 16384.

102. How long must the side of a square lot be to contain $2\frac{1}{2}$ acres?

103. One-half the square of a number is equal to 20808. Find three times the number.

104. A square lawn contains 576 square yards. What is the length of one side?

105. A garden contains 1875 square yards, and it is three times as long as it is broad. Find its length and breadth.

106. The product of the sum of two numbers by their difference is 756. The smaller number is 12. Find the larger.

VII. REVIEW.

MISCELLANEOUS DRILL EXERCISES.

107. My income tax at 18 mills on the dollar is \$10.80. On what amount do I pay tax?

108. Find the difference made in income by the transfer of £7680 from the 3 per cents at 65 to the $3\frac{1}{2}$ per cents at 60.

109. If 14 men can do in 12 days as much as 21 men and 4 boys can do in 7 days, how many boys are equivalent to 9 men?

110. A jeweler made three \$2 rings from \$5 worth of gold $\frac{9}{10}$ fine. How many \$1 rings would he make from \$6 worth of pure gold?

111. A horse thief going at the rate of 8 miles an hour has 32 miles of a start. He is pursued at the rate of 10 miles an hour. In how many hours will he be overtaken?

112. I sent my broker \$1248 to invest in flour at \$4 a barrel. How many barrels can he purchase after deducting his commission of 4% on the sum invested?

113. A house is insured for $\frac{3}{4}$ of its value at $1\frac{1}{2}\%$. The premium is \$405. What is the value of the house?

114. If 6 iron bars 4 feet long, 3 inches broad, and 2 inches thick weigh 144 pounds, how much will 15 weigh, each $6\frac{1}{2}$ feet long, 4 inches broad, and 3 inches thick?

115. A man has an income equal to 10% of his capital. He pays a tax of \$164, which is $2\frac{1}{2}$ per cent of his income. What is his capital?

116. A gold ring is 18 carats fine. Find the percentage of alloy in it.

117. A city contains 56,870 inhabitants. It has increased 10% in 10 years. What was its population 10 years ago?

118. The true discount is $\frac{5}{6}$ of the interest of the same sum and at the same rate. Find the rate.

119. The interest of a certain sum is \$36. The true discount \$32. Find the sum.

120. The bank discount exceeds the true discount on a certain sum for 4 years by $\$11\frac{2}{3}$, and for 8 years by \$40. Find the sum and rate.

121. What sum must I invest in 5% stock at 105 so that after paying an income tax of 8 cents in the dollar I may have a yearly income of \$1840?

122. A fails in business owing \$7200. His assets are \$3000. How much will B receive if A owes him \$450.

123. Allowing the net sum to be raised by a corporation to be \$9700, and the allowance for collection to be 3%, what is the gross amount to be assessed?

124. The premium for insuring a school-house at 2% was \$40. For what sum was it insured?

125. A premium of \$64.80 was paid for the insurance of \$8640 on stock of goods. What is the rate per cent of insurance?

126. My house is valued at \$2500; furniture, \$1000; library, \$1000. I insure the whole for $\frac{3}{4}$ of their value at $\frac{2}{3}\%$. What is my annual premium?

127. A grocer gives 14 ounces for a pound. How much does he cheat a customer who trades with him to the amount of \$40?

128. What is the value of my property if I pay \$648.12 $\frac{1}{2}$ taxes at 15 $\frac{1}{4}$ mills on the dollar, and am assessed at $\frac{5}{7}$ of the real value?

129. A contractor agreed to build a house in 60 days, and employed 15 men. If his time is extended 15 days how many men may he discharge?

130. A merchant insures goods at 2% for a sum sufficient to cover both the value of the goods and the premium. The goods are destroyed by fire and 75% of the claim is paid. The merchant gets \$782 less than the value of the goods. Find this value.

131. How large a sight draft on London can be bought for \$1174.20 when exchange is quoted at $4.89\frac{1}{4}$?

132. At what rate of interest will \$1600 amount to \$1880 in $2\frac{1}{2}$ years?

133. What principal will gain as much interest at 5% as \$250 will gain at 6% in the same time?

134. A has 50% more money than B. B's money is what per cent less than A's?

135. Ten per cent of $\frac{2}{3}$ of a thing is what per cent of $\frac{1}{4}$ of it?

136. After deducting a commission of $2\frac{1}{2}$ % an agent remitted \$146.25. What was the amount collected?

137. What must I ask for an article which cost me \$10 so that I can allow a discount of $33\frac{1}{3}$ % and still make 20%?

138. A sewing machine was sold at a net profit of 40% on the cost and at a discount on the asking price of $12\frac{1}{2}$ %. If the cost was \$100 what was the asking price?

139. A man buys stock at 75 and within a few days sells it at $79\frac{1}{2}$. Find his gain per cent.

140. Bought 37 shares of telephone stock at 107 and sold the same at 2% discount. How much did I lose?

141. Find the interest of \$242.40 from March 15 until October 28. (Sixty-day method.)

142. A certain sum in $6\frac{1}{2}$ months at 8% amounts to \$939. What sum would it amount to in 2 years?

143. Which is the better investment, 5% stock at 75 or 6% stock at 80?

144. Find the amount, compound interest, of \$4000 for $2\frac{1}{2}$ years at 7%?

145. A certain bank charges 9% discount. What rate of interest does it receive?

146. How much must I invest in 4% stock at 84 to secure a net income of \$1127 after paying an income tax of 2%?

147. The difference between the simple and compound interest of a certain sum for 3 years at 6% is \$55.08. Find the sum.

148. If the interest equals $\frac{3}{14}$ of the principal, what fraction of the principal is the true discount?

149. I bought 7200 bushels of wheat at $87\frac{1}{2}$ cents on a credit of 6 months, and immediately sold it for 88 cents cash. I lent the money received for the full time at 6%. Find my gain.

150. A bought goods to the value of \$1400 and sold them to B at a certain gain per cent. B sold them to C for \$1694 at the same rate of gain. What did B pay for the goods?

151. Goods marked 45% in advance of cost are sold at a discount of 20% on the marked price. What did a lot of goods cost if the gain on them was \$25.20?

152. A's income in 1884 was 50% greater than B's. In 1885 A's increased 10% and B's decreased 10%. Together in 1885 their incomes amount to \$7650. Find the income of each in 1884.

153. An agent's commission on sales at $1\frac{3}{8}\%$ was \$88. Find his employer's net receipts.

154. If a merchant adds 30% to the cost price of goods to make his selling price, what per cent must he deduct from his selling price to reduce it to cost price?

155. In a mixture of water and wine the water is 15% of the wine, and when 15 gallons of water are added the water is $22\frac{1}{2}\%$ of the wine. Find the original quantities.

156. A merchant sold a portion of his stock for \$1800. This was 15% of the value of what remained. Find the value of the original stock.

157. The entire profits of a business for 2 years amounted to \$7560. For the second year the profits were 10% greater than the profits of the first year. Find the profits for each year.

158. A factor sells 800 barrels of flour at \$6.52 $\frac{1}{2}$ and remits the net proceeds, \$5089.50. Find his rate of commission.

159. If a boat is rowed at the rate of 6 miles an hour and is driven 44 feet in 9 strokes of the oar, how many strokes are made in a minute?

160. A grocer sells 7 pounds of butter for what 8 pounds cost him. What is his gain per cent?

161. A bookseller buys books at 25% and 10% off list prices and sells at list prices. What per cent profit does he make?

162. How much money should I send my agent that he may buy 3000 pounds of tea at 36 cents and retain his commission of 4% of the sum invested?

163. A buys an article and sells it so as to gain $12\frac{1}{2}\%$. If he had bought it at 10% less and sold it for \$18 less he would have gained \$20. Find the cost of the article.

164. A farm is rented for \$300 in money and a certain number of bushels of wheat. When wheat is 80 cents a bushel the rent is $12\frac{1}{2}\%$ lower than when wheat is \$1.20 a bushel. Find the number of bushels of wheat.

165. A merchant bought a quantity of cloth and marked it at an advance of 40%. In selling he used a yard-stick 1 inch short. His total gain was \$330. Find the cost price of the cloth.

166. A sum of money in 10 years at 5% simple interest amounts to \$1250. In how many years more will it amount to \$1500?

167. The interest of \$200 equals the true discount on \$240, money being worth 6%. Find the time for which the latter sum is discounted.

168. A farmer buys a farm for \$8000 and pays cash \$3000, the balance of the price remaining on a mortgage at 6%. If the income from the farm is \$450, what rate of interest does he obtain for his money?

169. If the property of a city is valued at \$21,000,000, and a man who owns property assessed at \$7000 pays \$120 taxes, what is the total tax levied?

MISCELLANEOUS BUSINESS EXERCISES.

DIRECTION.—Compute interest and discount by the sixty-day method.

Transaction.—St. Louis, May 4, 1886. W. H. Sadler gives J. R. Lindsay an order on W. H. York & Co. for \$37.50, to be paid in goods from his store.

170. Write the order.

171. Write W. H. York & Co's account against W. H. Sadler.

Transaction.—Chicago, June 13, 1886. F. Wood buys of Acker & Merrall, on 30 days' credit, 10 hhds. Sugar, 15,500 lbs., at $9\frac{1}{2}$ c., and 20 chests Young Hyson Tea, 1250 lbs., at 53c. August 1, F. Wood gives a check on the Sixth National Bank in payment.

172. Write Acker & Merrall's invoice.

173. Write a statement, July 31.

174. Write F. Wood's check.

Transaction.—Montreal, July 15, 1886. T. Wells borrows \$239 from H. Block and gives his note at 60 days in payment. Interest 10%.

175. Write this note.

176. What amount will be due at maturity?

Transaction.—Montreal, July 25, 1886. H. Block has T. Wells' note discounted at the Bank of Montreal at 8% and receives cash in payment.

177. Indorse the note for H. Block.

178. How much cash should H. Block receive?

Transaction.—Burlington, August 5, 1885. T. Hall draws cash \$25.30 from his account in the Third National Bank. The same day he deposits \$422.85 and issues a check in favor of E. A. Blakely for \$14.90.

179. T. Hall had \$193.84 on deposit. How much has he now?

180. Write both checks.

Transaction.—E. Trout, of Toronto, owes W. H. Brown, of Jacksonville, \$520, and W. H. Brown owes O. R. Powers, of Chicago, \$420. Brown draws a sight draft (date, May 15) on Trout in favor of Powers for \$420, and a draft at 30-days sight in his (Brown's) own favor for the balance.

181. Write both of these drafts.

182. Accept each for E. Trout.

183. Who will present the \$420 draft, O. R. Powers' agent or W. H. Brown's agent?

184. Write W. H. Brown's letter to O. R. Powers.

185. Write W. H. Brown's letter to E. Trout notifying him that he is about to draw the drafts.

Transaction.—West Liberty, May 5, 1886. J. A. Cox borrowed \$220 from Richard Lees and gave his note at 60 days, drawing interest at 7%, in payment. At maturity a payment of \$50 was made by Cox, and a new note at 2 months drawing interest at 8% was given to cover the balance.

186. Write both notes for Richard Lees.

187. How much will have to be paid when the second note matures?

Transaction.—J. J. Sparling, Rochester, in a letter to W. Williams & Co., Chicago, encloses cash \$50 and a 60-day note (date, May 3) for \$75 in part payment of an account of \$265. He asks permission to close up the account with a 90-day note.

188. Write the letter for J. J. Sparling.

189. Write the 60-day note.

190. When will it be due?

191. Write W. Williams & Co's reply. (Favorable.)

192. Write W. Williams & Co's reply. (Not favorable.)

193. Indorse the note for W. Williams & Co., making it payable to the order of J. C. Jackman.

194. Find the interest on this note at 7%.

Transaction.—W. V. Wright, Hamilton, orders by telegraph from Eldredge Bros., Philadelphia, 25 Hart's Composition (price 75 cents), and 50 Houston's Chemistry (price \$1).

195. Write the message for W. V. Wright.
196. Write the invoice for Eldredge Bros. (Discount 35%).
197. Write a letter acknowledging receipt of books.

Transaction.—Eldredge Bros. draw (date, August 3) on W. V. Wright at 30 days after date, their own favor, and have the draft discounted at the Third National Bank at 8%.

198. Write the draft.
199. Accept it for W. V. Wright.
200. Indorse it for Eldredge Bros.
201. What is the date of maturity?
202. Find the cash proceeds.

Transaction.—Cassville, April 24, 1886. J. W. Elliott borrowed \$425 from T. M. Henry and gave his note at 90 days, drawing interest at 8%, in payment. At maturity a payment of \$132 was made by Elliott and a new note at 2 months, drawing interest at 10%, was given to cover the balance. J. W. Elliott paid the second note by a check on the First National Bank, at which bank the note was payable.

203. Write the first note for T. M. Henry.
204. Write the second note for T. M. Henry.
205. Henry requires an indorser. Indorse this second note yourself.
206. When will the second note be due?
207. Write the check.

EIGHTH DEPARTMENT.

EXAMINATION EXERCISES.

PAPER I.

1. If the divisor were half what it is the quotient would be 2001302. What is the quotient?

2. Find the sum of the five largest numbers that can be expressed by the figures 2, 1, 0, 3, and 7.

3. The sum of two numbers is 156; their common factor is 13; the difference between the other two factors is 2. What are the numbers?

4. The sum of two numbers is 2472. Their difference is $\frac{2}{5}$ of the larger number. What are the numbers?

5. Find the cost of 3540 pounds of hay at \$22.50 a ton.

6. When wheat is quoted at \$1.35 a bushel how much is it worth a cental?

7. Find the value in dollars and cents of a P. O. money order for £12 6s. 10d.

8. A man earns \$2.75 a day. How much will he earn in a month of July, the first day of which is Thursday?

9. How many days from March 13, 1885, until July 14, 1887?

10. Copper weighs 550 pounds and tin 462 pounds to the cubic foot. What will be the weight of a cubic foot of a mixture of 6 parts copper to 5 parts tin?

PAPER II.

11. How many apples must be cut up to give 300 boys $\frac{2}{3}$ of an apple each?

12. Divide a sovereign between A, B, and C so that A may have four pence more than B, and B ten pence more than C.

13. A and B together have \$9000; 3 times A's money is to 4 times B's as 3 is to 6. How much has each?

14. Find the cost of 2984 pounds of pork at \$7.85 per hundred-weight.

15. What will 4347 pounds of rice cost at 45 cents a stone?

16. How many inches are there in $2\frac{1}{2}$ chains?

17. Two numbers are to each other as $3\frac{1}{2}$ to $4\frac{1}{2}$. The greater is 52; what is the less?

18. How many sheets of paper are there in $2\frac{1}{2}$ reams?

19. If a ton of coal occupies 40 cubic feet, what will it cost to fill a bin 12 feet long, 6 feet wide, and 5 feet deep, with coal at \$6.50 a ton?

20. Two men or 5 boys can perform a piece of work in 7 days. How many men along with 3 boys would perform it in $3\frac{1}{3}$ days?

PAPER III.

21. Divide \$630 between two men so that their shares will be to each other as 7 to 2.

22. The difference between $\frac{1}{3}$ and $\frac{1}{5}$ of a number is 18. What is the number?

23. Find the cost of building a fence around a piece of land 80 rods square at 20 cents a rod.

24. How much water is there in a mixture of 50 gallons of wine and water worth \$1 a gallon, if 50 gallons of wine cost \$60?

25. How much is received for 18 pails of berries, each containing $\frac{2}{3}$ of a peck, at $12\frac{1}{2}$ cents a quart?

26. What will it cost to dig a cellar 90 feet by 60 feet, and $7\frac{1}{2}$ feet deep, at 30 cents a cubic yard?

27. Bought oranges at 10 cents a dozen and sold them at 5 for 11 cents. How much was gained on 11 boxes, each containing 20 dozen?

28. Three men earned \$37.80 in 6 days of 10 hours each. How much did each receive per hour?

29. I have an orchard 100 by 200 yards. The trees are 20 feet apart and 20 feet from the fence. How many trees are there?

30. A mixture of black and green tea weighing 13 pounds is worth \$7.50. If the proportions of each are interchanged the mixture will be worth \$8.10. The black tea is worth 70 cents a pound. Find the price of the green tea.

PAPER IV.

31. How many hours were there in the year 1800?

32. A quarter-section of land yielded 40 bushels of wheat to the acre. What was received for the crop at \$2.10 per cental?

33. What will it cost to bronze a cube, each edge of which is 3 feet, at $1\frac{1}{2}$ cents a square inch?

34. At \$36 an acre a farm is worth \$3060. It is 80 rods wide. Find the cost of fencing it at 75 cents a rod.

35. How many coins, each half an inch in diameter, can be placed in rows, touching each other, on a table $3\frac{1}{2}$ feet by 6 feet?

36. Find the value of £15.635 in dollars and cents.

37. Find the cost of $2\frac{1}{2}$ miles of barbed wire at $1\frac{3}{4}$ cents a yard.

38. The sum of two numbers is $9\frac{3}{4}$, and their difference is $4\frac{3}{4}$. Four times the larger is how many times the smaller?

39. The owner of $\frac{3}{11}$ of a mine sold $\frac{2}{10}$ of his share for \$40,500. What should he who owns $\frac{2}{5}$ of the mine get for $\frac{5}{9}$ of his share?

40. If 20 men can perform a piece of work in 12 days, how many men can perform another piece of work three times as large in $\frac{1}{3}$ of the time?

PAPER V.

41. Find the sum of all the prime numbers between 125 and 160.

42. The sum of two numbers is 100020002; their difference is 90009001. Divide twice the larger by $\frac{1}{2}$.

43. Find the value of a pile of wood 80 feet long, 20 feet wide, and 14 feet high, at \$3.20 a cord.

44. What number is the same fraction of $7\frac{1}{2}$ that $3\frac{1}{3}$ is of 15?

45. How many inches in width must a lumber dealer measure off in measuring 16-foot lumber, $1\frac{1}{2}$ inches thick, to make 2000 feet?

46. How many boards 14 feet long and 10 inches wide will be required to build a sidewalk 40 rods long and 4 feet 8 inches wide?

47. How many miles will a boy walk to plow 6 acres, turning a furrow of 9 inches?

48. How many apple trees, planted in rows 15 feet apart each way, will be required to cover a plot of $7\frac{1}{2}$ acres, 40 rods long?

49. A merchant sold 384 barrels of flour, part at \$7.25 and the rest at \$5.50 a barrel. He received for the whole \$42 more than if he had sold all at \$6.37 $\frac{1}{2}$ a barrel. How many barrels were sold at each price?

50. How many tons of ice can be put into an ice house 20 feet long, 12 feet wide, and 8 feet high, supposing ice to be $\frac{9}{10}$ as heavy as water?

PAPER VI.

51. What will it cost for sufficient inch lumber to build a tight board fence 5 feet high around a 10-acre field, 80 rods long, if lumber costs \$18 per M.?

52. Find the cost of 3 gross of pencils at the rate of 3 for 2 cents.

53. A horse trots $42\frac{1}{2}$ miles in $8\frac{1}{2}$ hours. At what rate per hour does he go?

54. Bought 220 bushels of wheat at \$1.30 a bushel and sold it at \$1.50 a cental. How much did I gain or lose?

55. A house and lot cost \$4200; the cost of the lot is $\frac{2}{5}$ that of the house. Find the cost of each.

56. A person bought a certain number of barrels of flour for \$4400. He reserved 40 barrels for his own use and sold $\frac{4}{5}$ of the remainder for \$3952, which was \$608 more than cost. Find the number of barrels he bought.

57. A regiment marching 4 miles an hour take 128 steps in a minute. What is the length of each step?

58. How many feet of lumber are there in a 2-inch plank 16 feet long and 9 inches wide?

59. If a pint contains $28\frac{7}{8}$ cubic inches, how many pints of water are there in a tank 11 feet by 7 feet, and 3 feet deep, filled to the top?

60. The sum of two numbers is 35875, and their difference is equal to $\frac{2}{5}$ of the greater number. What are the numbers?

PAPER VII.

61. If a merchant sells $\frac{3}{4}$ of an article for $\frac{7}{8}$ of its cost, what is his gain per cent?

62. A merchant buys cotton, and sells it at a profit of $\frac{1}{3}$ of the cost. Find the cost per yard if the selling price of 125 yards is equal to the profit on \$30 outlay.

63. The product of two numbers is 28, and one of them is $5\frac{1}{2}$; what is the other?

64. If the unit in which something is expressed be increased by one-third of itself, how must the number be altered?

65. How much will it cost to plaster a room 27 feet long, 15 feet wide, and 12 feet high, at 25 cents a square yard, allowing 432 square feet for doors and windows?

66. A man agreed to work for \$1.10 per day, and to forfeit 30 cents for each day he was idle. At the end of 24 days his wages amounted to \$19.40. How many days did he work?

67. I have a rectangular farm, the perimeter of which is 240 rods. It is twice as long as it is wide. How many acres does it contain?

68. A vessel contains 3 parts brandy and 2 parts water. How much of the mixture must be drawn off and replaced by water that the new mixture may be half and half?

69. What is the value of a rectangular field 60 rods long and 40 rods wide at \$55 an acre?

70. A man rides a certain distance at the rate of 6 miles an hour, and walks back the same distance at the rate of $3\frac{1}{2}$ miles an hour. If it takes him $4\frac{3}{4}$ hours to go both ways, what is the distance?

PAPER VIII.

71. What will be the expense of an oil cloth for a hall $6\frac{1}{4}$ yards long and 12 feet wide at \$1.35 a square yard?

72. How many quarts of berries at 27 cents a quart will pay for $14\frac{2}{3}$ yards of carpet at \$1.87 $\frac{1}{2}$ a yard?

73. A boy paid 20 cents for 200 apples and pears together, buying 25 apples for a cent and 25 pears for 3 cents. How many of each did he buy?

74. How much water must be mixed with 80 gallons of wine at \$1.25 a gallon to reduce the value 75 cents a gallon?

75. In a certain race A can beat B by 80 yards; but the day of the race proving foggy, A rows at $\frac{8}{9}$ of his usual rate and B at $\frac{9}{10}$ of his, when A beats B by only 26 yards. Find the length of the course.

76. A young man whose salary is \$28 a week pays \$7.50 a week for board and \$9.45 a week for other expenses. In how many weeks can he save enough to pay a debt of \$530.40?

77. Find the cost of papering a room 36 feet long, 24 feet wide, 18 feet high, with paper 18 inches wide at \$1.50 a roll, allowing 64 square yards for doors and windows. (One roll = 8 yards.)

78. A merchant's assets are \$4672 and his liabilities \$5840. How much can he pay on the dollar?

79. How much copper must be mixed with 35 pounds of silver of .9 fineness in order that the mixture may be of .7875 fineness?

80. If 3 apples and 5 peaches can be bought for 37 cents, and 2 apples and 3 peaches can be bought for 23 cents, how many apples can be bought for 20 cents?

PAPER IX.

81. How many cubical blocks $\frac{1}{4}$ of an inch on each edge can be put into a cubical box 2 inches deep, 2 inches wide, and 2 inches long?

82. A rectangular field $6\frac{1}{2}$ times as long as it is wide contains 300 acres. What is the distance around the field?

83. How high must wood be piled on a car which is 28 feet long and 8 feet wide to contain 14 cords?

84. I have $6\frac{1}{2}$ hours at my disposal. How far may I drive at 8 miles an hour that by walking back at $3\frac{1}{2}$ miles an hour I may have $22\frac{1}{2}$ minutes to rest?

85. Two cogged wheels work together, there being 32 cogs on one and 36 on the other. The larger wheel makes 24 revolutions per second. How often will the same cogs come in contact in one hour?

86. The ratio of the rates at which A and B can walk is as 4 to 5, and the distances they have to go are as 6 to 5. What will be the ratio of the times that they take?

87. At \$125 per acre what is the value of a farm 240 rods long and 90 rods wide?

88. What is the cost of 50 boards, each 12 feet long, 8 inches wide, and $1\frac{1}{2}$ inches thick, at $4\frac{1}{2}$ cents per foot, board measure?

89. A postman delivered daily for a period of 42 days 4 letters more than on the previous day. The aggregate delivery for the last 18 days was the same as that for the first 24 days. How many letters did he deliver altogether?

90. By selling an article for \$5 less than its value I lose $\frac{1}{8}\%$. Had I sold it for \$6 more than I did what would I have gained per cent?

PAPER X.

91. A mixture of 432 gallons of wine and water is in the proportion of 7 to 1. How much water must be added that the proportion may be as 6 to 1?

92. A merchant marks goods at an advance of $37\frac{1}{2}\%$ on cost, and allows a customer a reduction of 10% from his bill. Find the amount of that bill if the merchant makes a profit of \$9.90 on the transaction.

93. A man hired for a year and was to receive \$168 and 5 cords of wood. He left at the end of $7\frac{1}{2}$ months and received \$98 and the wood. Find the price of the wood per cord.

94. A grocer bought 100 loads of potatoes of 30 bushels each at $37\frac{1}{2}$ cents a bushel. Allowing $7\frac{1}{2}$ bushels for waste, how much will he gain by selling the rest at 15 cents a peck?

95. Write down all the common measures of 720 and 1008 and find their sum.

96. What number must be added to 20009 to make it exactly divisible by 201?

97. Find the average of 243, 1001, 32, 407, 63, 82, 943, 822, 1001, and 396.

98. Multiply 3001004 by $\frac{1}{4}$ and divide the product by $\frac{1}{2}$.

99. Divide \$4.09 between two boys so that one will receive 40 cents more than twice what the other receives.

100. A clock which loses 3 minutes in 12 hours is 20 minutes fast at noon on Monday. What o'clock will it indicate at 6 o'clock on Thursday morning?

PAPER XI.

101. A train 90 yards long moving at the rate of $\frac{1}{2}$ mile a minute meets another train moving half as fast again, and passes it in $6\frac{3}{22}$ seconds. Find the length of the last train.

102. A boy bought 15 pecks of nuts at 75 cents a peck and sold them at 10 cents a quart. How much did he make?

103. A man buys a house for \$8000. The taxes, insurance, etc., during the year amount to \$375. He rents the house for \$37 a month, and at the end of the year sells it for \$50 less than he paid for it. How much did he gain by the transaction?

104. The total increase of shipping at Quebec in a certain year was 1.7%. The decrease in the number of sailing vessels was 4.6%, and the increase in the number of steamers was 10.7%. Compare the number of steamers and sailing vessels.

105. A merchant bought goods and paid a certain import duty on them. He then marked them so as to gain $\frac{1}{5}$ of the total cost, but was obliged to throw off $\frac{1}{10}$ of this marked price, consequently his gain was only $\frac{1}{10}$ of the first cost of the goods. What fraction of the first cost was the duty?

106. What is the greatest unit of time with which 15 hours 12 minutes and 1 day 3 hours 33 minutes can be expressed as whole numbers?

107. A started to walk from Cobourg to Toronto, a distance of 70 miles, at the rate of 5 miles an hour, and at the end of every hour he rested 15 minutes. Two hours after A started B set out to drive from Cobourg to Toronto at the rate of 7 miles an hour, and at the middle of the journey he rested 2 hours. How long after B reached Toronto did A arrive there?

108. It costs 20 cents a line to insert an advertisement in a newspaper the first time, 5 cents a line for each of the 10 subsequent insertions, and then $2\frac{1}{2}$ cents a line. If a man is charged \$4.80 for a space of 6 lines, how often should his advertisement appear?

109. If I were to put posts 6 feet instead of 7 feet apart around a field I should require 66 posts more. The field is 40 rods one way. How many acres does it contain?

110. A merchant buys goods at a discount of 30% and 10% from the list price, and sells at 25% and 5% from the list price. What per cent does he gain?

PAPER XII.

111. How much gold 90% pure must be mixed with 24 ounces 65% pure so that the mixture may be 80% pure?

112. The interest on a certain sum for 6 years is \$261, and the true discount for the same time is \$180. Find the sum and the rate.

113. The sum of the interest, amount, true discount, and present worth is \$2400. The principal is \$1000. What is the interest?

114. A merchant bought 240 yards of tweed and 1560 yards of flannel, the price of the flannel per yard being $\frac{5}{18}$ that of the tweed per yard. He sold the tweed at a gain of 25% and the flannel at a loss of 20%, losing on the whole \$30. Find the cost of the tweed per yard.

115. When stock is bought at a discount of 20% and sold at a discount of 15% what per cent is gained?

116. A has $37\frac{1}{2}\%$ less money than B. B has how much per cent more than A?

117. A 27-gallon keg is half full of wine $\frac{2}{3}$ pure; 10% is drawn out and the keg filled with water. What is the percentage of its purity now?

118. A merchant sells goods at 25% profit and takes eggs at market value in payment. If one egg in each dozen is bad, what is his percentage of net gain?

119. A real estate agent gets \$95 for selling a house and lot for \$4750. What is his rate of commission?

120. Two pounds of tea and 6 pounds of sugar cost \$2.20; if sugar were to rise 50% and tea 10% they would cost \$2.66. Find the price per pound of tea and sugar.

PAPER XIII.

121. Stock bought at 10% premium pays 6% on the investment. What per cent would the same stock pay if bought at 17% discount?

122. The interest of a certain sum of money for $2\frac{1}{2}$ years at 7% is \$5.87 $\frac{1}{2}$. What is the true discount on the same sum for the same time and at the same rate?

123. I have to be at a certain place at a certain time. I find that if I walk at the rate of 3 miles an hour I shall be 20 minutes too late, and if at the rate of 5 miles an hour I shall be 12 minutes too early. How far have I to go?

124. What integer multiplied by the next greater gives a product of 1980?

125. How many shares of stock must be sold at 7% discount to realize \$6510?

126. One vessel, M, contains a mixture of 27 gallons of wine and 11 of spirits. Another vessel, N, contains a mixture of 43 gallons of wine and 14 of spirits. Compare the strength of the two mixtures, supposing the strength of spirits to be three times that of wine.

127. I sold a farm for \$5600 and gained as much per cent as the farm cost me. Find the cost.

128. What was the face of a draft bought for \$1970 when exchange was at $1\frac{1}{2}$ % discount?

129. A publisher wishes to net 14 shillings on each copy of a work. What price should he put upon it that he may be able to allow the trade 30% discount?

130. A man undertakes to build a house in 24 days. He employs 200 men to work 9 hours a day. At the end of 16 days the work is but one-half done. How many additional hands must he employ so that by increasing the day's work to 10 hours he may have the work completed at the end of the 24 days?

PAPER XIV.

131. Sold $\frac{2}{5}$ of an article for what $\frac{3}{7}$ of it cost. What was the gain per cent?

132. In what time will a \$1700 note drawing $7\frac{1}{2}\%$ simple interest double itself?

133. A farmer has 434 sheep in 3 fields. Two-thirds of the number in the first field equals $\frac{3}{4}$ of the number in the second, and $\frac{2}{3}$ of the number in the second equals $\frac{3}{4}$ of the number in the third. How many are in each field?

134. Two-thirds of A's money is to $\frac{4}{5}$ of B's as 3 to 4. Together they have \$1520. How much has B?

135. Two lots of cloth which together amount to 204 yards are in length as 8 to 9, and in price as 10 to 11. Their total value is £134 5s. Find the separate quantities and the prices per yard.

136. One side of an avenue is planted with maples 20 feet apart and the opposite side with balsams 28 feet apart. How many times will a maple be found directly opposite to a balsam in 7 miles?

137. What is the least number of even bushels of grain that can be exactly measured by a 3-quart, a peck, or a 5-gallon measure?

138. On a bill of \$78 having 8 months to run the true discount is \$6. On a bill of \$85 the true discount at the same rate is \$5. How long has the latter bill to run?

139. Five men agreed to do a piece of work, but two of the men did not come, and as a consequence the work was prolonged $3\frac{1}{2}$ days. In what time could the 5 men have done the work?

140. A man after a tour in Switzerland found that he had spent each day half as many shillings as the total number of days he had been away from home. His tour cost £57 12s. How many days did it occupy?

PAPER XV.

141. A merchant sells his goods at a profit of 15%. What amount of goods must he sell to gain \$2700?

142. If a town pays its tax collector 5%, and allows 5% for uncollected taxes, what should be the amount of taxes levied to realize \$36,100?

143. A and B do a piece of work for \$36. They agree to divide the money in proportion to their ability to work, which is as 2 to 3, and also to the time each worked, which is as 3 to 4. How much money should each get?

144. For what must goods worth \$19,100 be insured at $4\frac{1}{2}\%$ so that in case of loss the worth of the goods and the premium may be recovered?

145. If 5 men and 7 boys can reap a field of corn of 125 acres in 15 days, in how many days will it take 10 men and 3 boys to reap a field of 75 acres, each boy's work being equal to $\frac{1}{3}$ of a man's?

146. A sold goods which cost him \$300 to B at a certain rate of profit. B sold the same goods to C at the same rate of profit. C paid \$432 for the goods. What did B pay for them?

147. A man both in buying and selling cheats 10% by means of false scales. Find his fraudulent gain per cent on produce bought and sold.

148. If stock bought at 10% discount pays 5% on the investment, at what price should the same stock be bought to pay 6%?

149. In a liquid mixture there are 12 gallons of wine to 5 gallons of water. On the addition of 20 gallons of water the proportion is 4 gallons of wine to 3 gallons of water. What quantities were in the original mixture?

150. An estate agent bought two houses. The first cost $\frac{3}{4}$ as much as the second. In selling he gained 20% on the first and lost 5% on the second. His net gain was \$160. Find his net gain per cent.

PAPER XVI.

151. How many rods of fence will be required to enclose 2560 acres of land in a square form?

X 152. A and B together have \$136, and $\frac{2}{3}$ of A's money is equal to $\frac{3}{4}$ of B's. How much has each?

153. A grocer gained 25% by selling 12 pounds of sugar for a dollar. How much per cent will he gain by selling 15 pounds for one dollar?

154. Divide \$240 among A, B, and C so that A may have \$140 more than B and twice as much as C.

155. If the cost of an article had been 8% less the gain would have been 10% more. Find the gain per cent.

156. From a cask of wine worth \$1.20 a gallon $\frac{1}{6}$ part is drawn and replaced by wine worth 80 cents a gallon. What is now the value per gallon of the wine in the cask?

157. In walking 18 miles a man finds that the distance he walks in 100 minutes is $\frac{5}{7}$ of the remaining distance. What is his rate of walking?

158. Find the cost of fencing a rectangular field of $3\frac{2}{3}$ acres of smallest possible perimeter at \$1.50 a rod.

159. Thirteen hundred workmen in a factory are placed in charge of four superintendents, A, B, C, and D. For every 4 men under A there are 5 under C, and for every 9 under B there are 10 under D, and for every 2 under A there are 3 under B. How many are under each?

160. In the Centigrade thermometer the freezing point is zero and the boiling point is 100° ; in Fahrenheit's the freezing point is 32° and the boiling point is 212° . What degree C. corresponds to 77° F.?

PAPER XVII.

161. In 1880 February had 5 Sundays. When will this occur again?

162. A boy rowed $2\frac{1}{2}$ miles up a stream and back again in 1 hour and 40 minutes. He rowed down three times as fast as he rowed up. Find his rate of rowing in still water?

163. When it is noon at Greenwich it is 7 o'clock a.m. at Philadelphia. What is their difference of longitude?

164. A square courtyard is bordered by a gravel drive 10 yards wide, and the drive covers 4000 square yards. How many square yards in the enclosed grass plot?

165. Find the cost of excavating a cellar 6 feet deep for a house 20 feet by 30 feet, at 10 cents per cubic yard for the first foot in depth, 12 cents for the second, 15 cents for the third, 16 cents for the fourth, 18 cents for the fifth, and 20 cents for the sixth.

166. What fraction of the area of the floor of a room 35 feet square would be left uncovered by 147 yards of carpet 30 inches wide?

167. A contractor found that it would take 16 men 6 weeks to finish a piece of work. He decided to have it done in 8 days. How many men should he employ?

168. Three men own altogether 21,950 sheep; $\frac{3}{4}$ of the number owned by the first, $\frac{5}{8}$ of the number owned by the second, and $\frac{8}{9}$ of the number owned by the third are equal. How many sheep has each?

169. A society collected for charitable purposes a fund of £960. Each member paid as many pence as there were members in the whole society. How many members were there?

170. I held two notes, each due in 2 years, the aggregate face value of which was \$1020. One was discounted at 5% bank discount and the other at 5% true discount. The total proceeds was \$923. What was the face value of each?

PAPER XVIII.

171. A cubic foot of water weighs $62\frac{1}{2}$ pounds, and a floating body displaces its own weight of water. How many cubic feet of water will be displaced by a ship and cargo weighing 500 tons?

172. A miller exchanges flour worth \$5.40 per barrel with a farmer for hay worth \$9 per ton. If the farmer asks \$10.50, what price should the miller put on the flour?

173. Two trains start at the same time from London and Exeter and proceed towards each other at the rates of 24 and 32 miles an hour respectively. When they meet it is found that one train has run 24 miles more than the other. How far is it from London to Exeter?

174. If I sell my horse for £62, and my carriage for £26, I shall gain 10% on the original cost of both; but if I sell the horse for £63, and the carriage for its original cost, I shall lose 10%. Find the original cost of each.

175. A cistern is 10 feet wide by 12 feet long, and the water in it is 8 feet deep. If a rectangular stone 3 feet by 2 feet by 1 foot be dropped into the cistern, how much will the water rise?

176. A merchant deducts 20% from the marked price of his goods and still makes a profit of 16%. At what advance on cost are the goods marked?

177. It costs \$800 to fence a farm 80 rods square. How much more will it cost to fence a farm of equal area in the form of a rectangle four times as long as it is wide with the same kind of fence?

178. A room is $8\frac{2}{3}$ yards long and $6\frac{1}{3}$ yards wide. It costs \$12.60 to cover the walls with paper 2 feet wide and costing 7 cents a yard. Find the height of the walls.

179. A can do a piece of work in 8 days when B helps him 5 days; B can do the work in 9 days when A helps him 5 days. How long will the work take both when working together?

180. A starts from Belleville for Trenton at the same time that B starts from Trenton for Belleville. They arrive at their destinations respectively 40 minutes and 90 minutes after meeting each other. Compare their rates.

PAPER XIX.

181. A, B, and C do a piece of work for which \$110 is paid. Working alone it would take A $1\frac{3}{4}$ times as long as B and C together, and B $2\frac{1}{3}$ times as long as A and C together. How should the money be divided?

182. A person's income is derived from the commission on £6975 at a certain rate per cent, and on £5360 at 1% more than the former rate. His whole income is £547. Determine the rates.

183. A factory tailor can make 5 shirts in 2 hours; whether will it be more profitable for him to be paid at the rate of 18 cents an hour or 8 cents a shirt?

184. A cistern has three pipes, A, B, and C. By A and B together it can be filled in 72 minutes, and emptied by C in 90 minutes. A and C when open together empty the cistern in 3 hours. In what time will the cistern be filled when all three are open together?

185. I received 9% dividend on stock purchased at 40% discount. What per cent did my investment pay?

186. What capital should be invested in 5% stock at $96\frac{1}{4}$ to produce the same income as £2121 invested in 3% stock at 77?

187. What is the amount of a note due in 8 months at $4\frac{1}{2}\%$ if the difference between the true and the bank discount is 9 shillings?

188. What principal will amount to \$455.65 in $7\frac{1}{2}$ years at 4% simple interest?

189. B can beat A by $\frac{1}{2}$ a mile in a course of 4 miles. C can beat B by 2 minutes and A by 1 mile over the same course. Find the rate per hour of A, B, and C.

190. In arranging the terms of a partnership A has a note of \$420 not bearing interest. B has a similar note of \$345 but having three times as long to run. A is willing to allow \$300 for B's note. How much should B allow for A's?

PAPER XX.

191. A traveller on a train notices that $2\frac{1}{4}$ times the number of spaces between the telegraph poles that he passes in a minute is the rate of the train in miles per hour. How far apart are the poles?

192. A merchant purchased a number of pounds of tea for \$12. Had he bought 10 pounds more he would have been allowed a discount of 10% on the whole, and the price would have been \$18. How many pounds did he buy at first?

193. The prices of seats at a lecture were 50 cents, 35 cents, and 25 cents. It was known that for every 3 seats sold at 35 cents there were 4 sold at 25 cents, and for every 3 sold at 50 cents there were 4 sold at 35 cents. The whole sum realized from the sale of seats was \$76.20. How many 25-cent seats were sold?

194. The government map of Manitoba is drawn to a scale of 6 miles to the inch. What length of line on the map will represent one side of a square farm containing 160 acres?

195. A woman bought a certain number of yards of dress goods at \$1 a yard, and half as many yards of lining at half as much a yard. The cost of the whole was \$12.50. How many yards of each did she buy?

196. An article was sold at a price which was $\frac{1}{3}$ above cost. Had the cost been $\frac{2}{3}$ of what it really was, and the selling price remained the same, the gain would have been \$3. Find the first cost.

197. There were two trains, one 210 feet and the other 230 feet long. When going on parallel tracks in the same direction one passed the other in 15 seconds. When going in opposite directions they passed in $3\frac{3}{4}$ seconds. How many miles an hour were they moving?

198. A customer bought what he supposed was \$45 worth of tea, but a false weight having been used he got only \$42 worth. How many ounces were given him for a pound?

199. Show why 8 must be a factor of the product of any two consecutive even numbers.

200. A dealer imported 50 chests of tea containing 30 pounds each and invoiced at 45 cents a pound. He paid a duty of 15% on the invoiced price and \$17.50 freight. When he unpacked the tea he found that 5 chests were damaged so that he had to sell them for 50 cents a pound. At what price per pound must he sell the remainder to gain 20% on his entire outlay?

PAPER XXI.

201. If I buy for 10% less I shall gain 15% more. What is my rate of gain?

202. A, B, and C are partners. A receives 35% of the profits. Of the remainder B's share is 60% more than C's. C's income is increased by \$150 when the profits rise from 10% to 12%. Find the sum invested by each.

203. A speculator bought a piece of land at \$1500, and afterwards sold it for \$1795.40. The buying and selling were done through a broker, who charged 2% for each transaction. Find the speculator's actual gain per cent on the entire cost.

204. How many pounds of tea at 64 cents a pound must a grocer mix with 4 pounds at 82 cents a pound that he may sell the mixture at 96 cents a pound and gain $33\frac{1}{3}\%$ on his outlay?

205. A barrel of sugar containing 280 pounds cost \$21. In weighing it out it lost 5%. What per cent is gained by selling it at $10\frac{1}{2}$ cents a pound?

206. Bought 2000 pounds of sugar, part at 7 cents a pound and part at 10 cents a pound. Had I bought the whole at 8 cents a pound it would have cost me \$13 less than I paid for it. How many pounds of each kind did I buy?

207. How much did the creditors receive on the \$, the account of a bankrupt estate being as follows:—

Goods valued at \$3500, sold at $62\frac{1}{2}$ c. on the \$;

Book debts amounting to \$1750, sold at 55c. on the \$;

Notes receivable amounting to \$680, sold at 80c. on the \$;

Expenses, 2% of the total sum realized;

Liabilities, \$2350, \$750, \$1300, \$1365, and \$724.50?

208. When currency is at a discount of 40% what is the corresponding premium on gold?

209. Find the cost of digging a drain 48 rods long, 3 feet deep, $3\frac{1}{2}$ feet wide at the top, and $2\frac{1}{2}$ feet wide at the bottom, at 4 cents a cubic yard.

210. If sterling exchange is quoted at \$4.84, and exchange in London on Frankfort is at 20.25 marks per £, what should a bill of 3800 marks be worth in New York?

PAPER XXII.

211. If gold is at $12\frac{1}{2}$ % premium, what is the corresponding discount on currency?

212. If $\frac{3}{4}$ of the selling price is 20% less than the cost, what is the gain per cent?

213. A piece of work was to be performed by 6 men in a certain time; 2 men, however, failed to come, and the work was consequently prolonged 6 days. In what time should it have been done?

214. A grocer intending to gain 20% on his stock of tea fixed his prices accordingly. After selling $\frac{2}{3}$ of his stock he was forced to reduce his price 10 cents per pound, and so gained only $14\frac{2}{3}$ % on the whole. Find the cost price per pound of the tea.

215. How many thousand feet, board measure, are there in 100 sticks of square timber each 30 feet long and 16 inches by 15 inches at the ends?

216. A certain sum of money if invested in 6% stock at 90 purchases \$400 more stock than if invested in 7% stock at 95. Find the difference of income.

217. A man drove to town at the rate of 8 miles an hour, and after remaining there 28 minutes he returned at the rate of 5 miles an hour. He was absent 6 hours. How far was he from town?

218. A train started to go from P to Q, 210 miles, at 30 miles an hour, but after having gone 100 miles it was delayed 20 minutes by an accident. It finished the trip at 22 miles an hour. How much behind time was it?

219. If I ask 30% profit on an article, but fall 10% on my asking price, what rate of profit do I make?

220. I received an 8% dividend on stock at 80. I invested my dividend in the same stock and then had \$6875 stock. Find my dividend.

PAPER XXIII.

221. A merchant buys a quantity of syrup for \$750. By using a false measure and by marking at 35% gain he nets \$375. What fraction will express the size of his measure?

222. A merchant buys sugar at 8 cents a pound and sells it at a profit of 25%, but by mistake uses a pound weight $\frac{1}{10}$ too heavy. Having sold all his sugar he finds he has lost \$16 by overweight. How many pounds did he buy?

223. A sold B a carriage which cost him \$150 at $12\frac{1}{2}\%$ profit. B sold it to C at a profit of 10%. What would have been A's profit per cent if he had sold to C for the price C paid?

224. A person makes a journey 1248 miles in 12 days, going 13 hours a day. In how many days of 9 hours will it take him to go 576 miles at the same rate?

225. A can do as much work in 3 hours as B can do in 5 hours. How long will it take A to finish a piece of work of which B has done $\frac{3}{4}$ in 20 days?

226. The wages of A and B together for $7\frac{1}{2}$ days will pay the wages of A alone for 20 days. For how many days will this sum pay the wages of B alone?

227. A farmer sold 14 bushels of wheat and 16 bushels of oats for \$13.52. He received for the wheat 32 cents a bushel more than for the oats. Find the price of each per bushel.

228. If a grocer sells a tub of butter at 22 cents a pound he will gain 168 cents, but if he sells at 17 cents a pound he will lose 112 cents. Find the weight of the tub and the cost per pound.

229. At what time between 10 and 11 are the hands of a clock together?

230. A can do $\frac{1}{3}$ of a piece of work in 2 hours; B can do $\frac{1}{2}$ of the remainder in 3 hours, and C can do the remainder in 4 hours. How long will the work take them if all work together?

PAPER XXIV.

231. One man walks $2\frac{1}{2}$ miles in 35 minutes, and another walks $4\frac{1}{2}$ miles in 60 minutes. How much of a start must the slower have so that in a race of $7\frac{1}{2}$ miles they may come in even?

232. The H. C. F. and L. C. M. of two numbers between 100 and 200 are 6 and 3150. Find the numbers.

233. How far will a carriage have traveled when the fore wheel will have turned 60 times more than the hind wheel, the circumferences being 8 feet and 10 feet?

234. A garrison has provisions for 60 days. After 12 days a reinforcement of 3000 men arrives. By putting the men on half rations the provisions are made to last 32 days longer. How many men in the original garrison?

235. A grocer spent equal sums in buying tea, coffee, and sugar. He gained 20% on the tea, 10% on the coffee, and lost 8% on the sugar. His total receipts were \$3864. Find the cost of each.

236. Two-fifths of a mixture of wine and water is wine, but when 10 gallons of water are added the wine is only $\frac{7}{20}$ of the whole. Find the quantities at first.

237. Add together the 40 numbers beginning with 1002.

238. Three-fourths of the difference between two numbers is equal to $\frac{1}{6}$ of their sum. The smaller number is 287. Find the larger.

239. The difference between the simple and the compound interest of a certain sum at 8% for 2 years is \$1.20. Find the sum.

240. How many pounds of butter must be mixed with $12\frac{1}{2}$ pounds of lard that the mixture may contain $33\frac{1}{3}\%$ of butter?

PAPER XXV.

241. What number multiplied by $\frac{3}{11}$ of itself will give 1188?

242. A man engaged with a farmer at \$1.10 a day for each of 90 days that he worked. He promised to forfeit 60 cents for each idle day. At the end of the time he received \$61.60. How many days did he work?

243. A boatman can row 10 miles an hour in still water. In going a certain distance down a stream which runs at the rate of 2 miles an hour it takes him 10 hours. How long will it take him to row back?

244. Find the time between 8 and 9 when the minute hand of a clock is 7 minute spaces behind the hour hand.

245. An agent sold wheat at 4% commission and invested the proceeds, less his double commission, in sugar. He received 2% commission on the actual sum invested, and his whole commission was \$63. Find the cost of the sugar?

246. How much does a grocer who gives only $15\frac{3}{8}$ ounces for a pound cheat a customer who buys goods amounting to \$64?

247. A starts to walk from one town to another at the average rate of 3 miles an hour. Twenty minutes later a bicyclist, B, starts on the same journey at the rate of 12 miles an hour. On reaching the second town B rests $\frac{1}{4}$ of an hour, and after riding 20 minutes on his return journey meets A still on his way. What is the distance between the two towns?

248. The assessed value of the property in a town is \$3,265,000, and the tax to be raised is \$39,180. What will be the rate on the \$, and what will be the amount of A's taxes, his property being assessed at \$15,000?

249. A can do as much work in 2 days as B can do in $2\frac{1}{2}$, and B can do as much in 2 days as C can do in $2\frac{1}{2}$. They all start together and complete a job worth \$61. How much of the money should A receive?

250. A St. Paul investment company declared a dividend of 8%, and one of the shareholders, who lived in Toronto, drew on St. Paul for his money. He received \$318.40, the rate of exchange being $\frac{1}{2}\%$ discount. Find how many shares this man owned.

PAPER XXVI.

251. If a parcel of 12 pounds weight is carried 80 miles by rail for 2s. 4d., and the rate for the distance over 50 miles is $\frac{2}{3}$ of the rate for the first 50 miles, how far can a parcel of 8 pounds be carried for 4d.?

252. There are 3 sections of land in such a shape that the length is 6 times the breadth. The whole is divided into 96 rectangular lots, each of which is twice as long as it is wide. Find the dimensions in rods of each lot.

253. If I sell one of my two farms for \$4500 and the other for \$1800 I will gain 5% on the cost of both; but if I sell the dearer farm at \$4000 and the other at cost I will lose 5%. Find the cost of each farm.

254. A mixture of black and green tea is worth \$22.65. Another mixture with the proportions interchanged is worth \$24.60. Four pounds of black tea cost as much as 5 pounds of green. Find the cost price of each per pound.

255. A merchant bought a certain number of yards of cloth at \$2.50 per yard. He sold $\frac{2}{5}$ of the cloth at 25% profit, and on the sale of the remainder he lost \$15. If his total loss was equal to 5%, find the number of yards.

256. A and B buy the apples in a barrel for \$2.25. B pays 75 cents of this price, A paying the remainder. It costs B 25 cents to deliver the apples, and A gives 15 cents for the barrel, which B keeps. If they share the apples equally, who owes the other, and how much?

257. An agent sells flour on commission of 2%, and purchases goods on true commission of 3%. If he had received 3% for selling and 2% for buying his whole commission would have been \$5 more. Find the value of the goods bought.

258. The owner of a mill driven by water power got an insurance on it at the rate of $1\frac{7}{8}\%$. He afterwards introduced steam power, and the company took an additional risk of \$1200. They, however, raised the rate $\frac{1}{2}\%$ on account of the greater danger. The extra premium required amounted to \$53.50. For what amount was the mill first insured?

259. A railway train, after travelling for 1 hour, has an accident which delays it 60 minutes, after which it proceeds at $\frac{3}{5}$ of its former speed and arrives at its destination 3 hours behind time. Now, had the accident occurred 50 miles further on the train would have arrived $1\frac{3}{4}$ hours sooner. What is the length of the line?

260. A rectangular court is 50 yards long and 30 yards broad. It has paths joining the middle points of the opposite sides, each 6 feet wide, and a path of the same breadth running all around it. The remainder is covered with grass. The cost of the pavement was $12\frac{1}{2}$ cents per square foot, and of the grass 70 cents per square yard. What was the cost of laying out the court?

PAPER XXVII.

261. A man's income is derived from the proceeds of \$2275 at a certain rate per cent, and \$2710 at 1% more than the former rate. His whole income is \$453. What are the rates?

262. A boy can split a cord of wood in 3 hours and pile a cord in 45 minutes. How long will it take him to split and pile 6 cords?

263. The time occupied by a train 352 yards long, going at the rate of 40 miles an hour, in crossing a bridge is 50 seconds. Find the length of the bridge.

264. A man sells goods for \$1125. Half he sold at an advance of 25% on the cost, $\frac{2}{3}$ at an advance of $12\frac{1}{2}\%$, and the remainder at $\frac{1}{2}$ of the cost. What did he pay for the goods?

265. Equal weights of gold and silver are in value as 20 to 1, and equal volumes are in value as 1284 to 35. A certain volume is composed of equal weights of gold and silver. Find how many times more valuable the same volume would be were it composed wholly of gold.

266. A person buys a horse upon borrowed money, for which he pays 6% per annum. The horse earns 70 cents a day and costs $\frac{1}{2}\%$ of his purchase price for daily keeping. The owner sells him at the end of a year for \$50 and realizes \$132.40 upon the whole transaction. What did the horse cost?

267. A man owns a horse and a saddle; $\frac{1}{4}$ of the value of the horse is equal to 4 times the value of the saddle; the horse and saddle together are worth \$170. Find the value of each.

268. By selling an article for \$21 I lost $12\frac{1}{2}\%$. At what price should I have sold it in order to gain $12\frac{1}{2}\%$?

269. The pendulum of one clock makes 24 beats in 26"; that of another 36 beats in 40". If they start at the same time, when first will the beats occur together?

270. What is the market price of 5% bank stock which yields 6% interest after an income tax of 3% has been paid?

PAPER XXVIII.

271. A person sells a certain amount of 5% stock for 86 and invests in 6% at 103, and by so doing changes his income by \$1. Is the change an increase or a decrease? How much stock did he sell?

272. Lead is 11.4 times and zinc 7.2 times as heavy as water. If 3 pounds of lead and 2 pounds of zinc be melted together, compare the weight of the mixture with that of water.

273. I found that by giving 13 cents each to a certain number of beggars I would have just 10 cents left, but by giving each of them 17 cents I would not have enough by 10 cents. How many beggars were there?

274. A contractor found that he would have \$75 left if he paid his men 85 cents each, but that he would need \$125 more if he paid them \$1.25 each. How many men were there?

275. A boy earned 15 cents a day for prompt attendance during the 200 school days in the year, and forfeited 12 cents each day he was tardy. At the end of the year he received \$29.73. How many days was he punctual?

276. A crew can row up a stream a certain distance in 64 minutes and back again in 60 minutes. Determine the distance, the rate of the stream being half a mile an hour.

277. Two-thirds of a number increased by $\frac{1}{3}$ of the number, and this increased by 34, will give twice the number. Find the number.

278. When the hour hand of a clock is 22 minutes ahead of the minute hand, how far must the minute hand move to overtake the hour hand?

279. If the time past noon increased by 90 minutes equals $\frac{5}{11}$ of the time from noon till midnight, what time is it?

280. When wheat is worth 90 cents a bushel a baker's loaf weighs 9 ounces. How many ounces should it weigh when wheat is worth 72 cents a bushel?

PAPER XXIX.

281. A pound of tea and 7 pounds of sugar cost \$1.64. If sugar were to rise 60% and tea 25% they would cost \$2.33. Find the price per pound of tea and sugar.

282. A person sells 184 shares of 4% stock at 92 and invests in $3\frac{1}{2}\%$ stock, gaining \$160 per annum by the change of income. At what price did he purchase the latter stock?

283. In erecting a house I paid three times as much for material as for labor. Had I paid 5% less for the material and 4% more for the labor the house would have cost me \$2334. What did the house cost?

284. How many pounds of coffee at 24 cents must a merchant mix with 6 pounds at 36 cents that he may sell the mixture at 40 cents and gain $33\frac{1}{3}\%$?

285. Four pipes, A, B, C, and D, fill a cistern in 3, 12, 15, and 20 hours respectively. Four other pipes empty it in 4, 10, 30, and 60 hours respectively. If the eight pipes are open together, in how many hours will the cistern be filled?

286. A person increases his capital 20% annually, less a yearly expenditure of \$500. At the end of four years his capital amounts to \$18,052. Find his original capital.

287. A man bought a piece of cloth at \$1.40 a yard and lining for it at 60 cents a yard. There were 35 yards altogether, and the total price was \$37. How many yards were there of each?

288. A certain sum amounts to \$2070 in 6 months, and to \$2420 in 3 years, simple interest. What is the rate per cent?

289. How far must a person proceed on a stage which travels $4\frac{1}{2}$ miles an hour in order that he may walk back at the rate of 3 miles an hour and be gone just $7\frac{1}{2}$ hours?

290. A man buys 150 pounds of sugar, and after selling 100 pounds finds that he has been selling at a loss of 5%. At what per cent advance on the cost must he sell the remaining 50 pounds that he may gain 10% on the entire transaction?

PAPER XXX.

291. A lump of gold 22 carats fine contains 36 ounces of alloy. How many ounces of alloy in a lump of the same weight only 16 carats fine?

292. Find the smallest multiplier that will make 3428 a perfect square.

293. Show without division that 36432 contains 8, 9, and 11 as factors.

294. How many days elapsed between the annular eclipse of May 15, 1836, and that of March 15, 1858?

295. By selling goods at 60 cents a pound 8% is lost. What advance must be made in the price in order to gain 15%?

296. Divide \$54.25 among three persons, giving the second \$10 less than the first and twice as much as the third.

297. A substance is weighed from both arms of a false balance, and its apparent weights are 18 pounds and 8 pounds. Find its true weight.

298. When the sum of the interest and true discount is subtracted from the sum of the true present worth and amount, the remainder is \$2460. What is the present worth?

299. A merchant buys goods at a discount of 40% and 20% from the list prices, and sells at a discount of 10% and 5%. What is his gain per cent, allowing 10% of his sales for bad debts?

300. X, Y, and Z formed a partnership to carry on a milling business. X owned the site, valued at \$1500; Y put up the building, worth \$2400; and Z put in the machinery, costing \$3000. They ran the mill for one year on this basis, and then agreed to take equal shares in it; but meantime the value of the land had increased 20%, the value of the building had decreased 10%, and the worth of the machinery had depreciated 25%. Who should pay the other, and how much?

PAPER XXXI.

301. What is a *concrete* number? An *abstract* number?
302. Show that a unit is not necessarily a single thing.
303. Why do we begin at the unit's place in the addition of numbers?
304. How may the accuracy of the process of subtraction be verified?
305. Any number is divisible by 9 if the sum of its digits be divisible by 9. Why?
306. The product of the greatest common measure and least common multiple of two numbers is equal to the product of the two numbers. Why?
307. Compare the *metric* system of weights and measures with the system in general use.
308. Prove the rules for multiplication and division of fractions.
309. Show that the true discount of any sum of money is the true present worth of the bank discount for the same time and rate.
310. Prove that a number will be divisible by 11 if the sum of the digits in the even places differs from that in the odd places by a multiple of 11.

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